ABBREVIATIONS / ACRONYMS USED

APCTT	Asian and Pacific Centre for Transfer of Technology
CBDT	Central Board of Direct Taxes
CDC	Consultancy Development Centre
CDS/ISIS	Computerized Data Services/Integrated Set of Information Systems
CII	Confederation of Indian Industry
CITT	Centre for International Trade in Technology
CSIR	Council of Scientific & Industrial Research
DBT	Department of Bio-Technology
DCPC	Department of Chemicals & Petrochemicals
DCSSI	Development Commissioner, Small Scale Industries
DRDO	Defence Research and Development Organization
DSIR	Department of Scientific & Industrial Research
ESCAP	Economic and Social Commission for Asia and the Pacific
EXIM	Export-Import
FC	Foreign Collaborations
FICCI	Federation of Indian Chambers of Commerce and Industry
ICAR	Indian Council of Agricultural Research
ICAS	Indian Council of Ayurveda & Siddha
ICMR	Indian Council of Medical Research
ICSSR	Indian Council of Social Sciences Research
ICSTI	International Centre for Science & Technology Information
IDAMS	Internationally Developed Data Management System
IGNOU	Indira Gandhi National Open University
IIFT	Indian Institute of Foreign Trade
IISc	Indian Institute of Science
IIT	Indian Institute of Technology
INFLIBNET	Information Library Network
INSA	Indian National Science Academy
IPR	Intellectual Property Rights
ISRO	Indian Space Research Organization
ITPO	India Trade Promotion Organization
LAN	Local Area Network
LCA	Light Combat Aircraft
MDR	Multi Drug Resistance
MIT	Ministry of Information Technology
MoU	Memorandum of Understanding
NACIDS	National Access Centres to International Database Services

(Continued)

NAFEN	National Foundation of Indian Engineers
NCAER	National Council of Applied Economic Research
NCSI	National Centre for Science Information
NICMAR	National Institute of Construction Management and Research
NID	National Institute of Design
NIDC	National Industrial Development Corporation
NIFT	National Institute of Fashion Technology
NMCC	National Manufacturing Competitiveness Council
NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
NSTMIS	National Science and Technology Management Information System
PSU	Public Sector Undertaking
SIRO	Scientific and Industrial Research Organization
SME	Small and Medium Enterprise.
TCO	Technical Consultancy Organization
TDB	Technology Development Board
TEDO	Technology Export Development Organization
TePP	Technopreneur Promotion Programme
TIFAC	Technology Information Forecasting and Assessment Council
TM	Technology Management
TQM	Total Quality Management
UGC	University Grants Commission
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
WIPO	World Intellectual Property Organization

Annexure 1

STATEMENT ON RECOGNITION OF IN-HOUSE R&D UNITS

Month	Year	Receipts	Cumulative Receipts	Disposal	Cumulative Disposal	*Cumulative pendency at the end of the month
January	2007	18	18	12	12	53
February	2007	10	28	8	20	55
March	2007	15	43	13	33	57
April	2007	19	62	16	49	60
May	2007	13	75	11	60	62
June	2007	13	88	8	68	67
July	2007	14	102	6	74	75
August	2007	17	119	8	82	84
September	2007	7	126	2	84	89
October	2007	20	146	6	90	103
November	2007	8	154	2	92	109
December	2007	15	169	15**	107	109

* *Including pendency of 47 applications carried over from the year 2006.*

** *Approval under process.*

Annexure 2

STATEMENT ON RENEWAL OF RECOGNITION OF IN-HOUSE R&D UNITS WHOSE RECOGNITION WAS VALID UPTO 31.03.2007

Month	Year	Receipts	Cumulative Receipts	Disposal	Cumulative Disposal	Cumulative Pendency at the end of the month
December	2006	15	15	-	-	15
January	2007	115	130	-	-	130
February	2007	127	257	-	-	257
March	2007	89	346	32	32	314
April	2007	36	382	46	78	304
May	2007	16	398	104	182	216
June	2007	10	408	64	246	162
July	2007	6	414	65	311	103
August	2007	2	416	44	355	61
September	2007	5	421	27	382	39
October	2007	1	422	27	409	13
November	2007	-	422	-	409	13
December	2007	-	422	-	409	13

Annexure 3

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE MORE THAN RS. 500 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
1.	Alembic Ltd.	3454
2.	Aarti Drugs Ltd.	512
3.	Ashok Leyland Ltd.	10494
4.	Asian Paints (India) Ltd.	794
5.	Associated Cement Companies Ltd.	682
6.	Astra Microwave Products Ltd.	1542
7.	Atul Ltd.	648
8.	Audco India Ltd.,	592
9.	Aurobindo Pharma Ltd.	9671
10.	BASF India Ltd.,	2244
11.	Bajaj Auto Ltd.	10674
12.	Bajaj Tempo Ltd.	1974
13.	Bharat Earth Movers Ltd.	1822
14.	Bharat Electronics Ltd.	10868
15.	Bharat Forge Ltd.,	817
16.	Bharat Heavy Electricals Ltd.	7330
17.	Bharat Petroleum Corporation Ltd.	1202
18.	Bharat Serums & Vaccines Ltd.	936
19.	Bilcare Ltd.	538
20.	BPL Ltd.	2643
21.	BST Ltd.	928
22.	Biocon India Ltd.	4787
23.	Biological E. Ltd.,	725
24.	Brakes India Ltd.	1742
25.	Cadila Pharmaceutical Ltd.	1368
26.	Cadila Healthcare Ltd.	1395
27.	Castrol India Ltd.	607
28.	Central Mine Planning & Design Inst. Ltd.	1322
29.	CMC Ltd.	1181
30.	Cipla Ltd.	17573
31.	Crompton Greaves Ltd.	1771
32.	Cummins India Ltd.	2256
33.	Delphi – TVS Diesel Sysems Ltd.	597
34.	Divi’s Laboratories Ltd.	758
35.	Dr. Reddy's Laboratories Ltd.	29729

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
36.`	Eicher Motors Ltd.	2152
37.	Electronics Corporation of India Ltd.	3557
38.	Emcure Biotech Ltd.	520
39.	Emcure Pharmaceuticals Ltd.	2853
40.	Engineers India Ltd.	558
41.	Escorts Ltd.(Tractor Division)	1605
42.	Excel Industries Ltd.	671
43.	FDC Ltd.	536
44.	Gharda Chemicals Ltd.	1132
45.	Gland Pharma Ltd.	520
46.	Glenmark Pharmaceuticals Ltd.	5137
47.	Gujarat State Fertilizers & Chemicals Ltd.	838
48.	GMM Pfaudler Ltd.	894
49.	Greeves Cotton Ltd.	1079
50.	Gujarat Olio Chem Ltd.	571
51.	Himachal Futuristics Communication Ltd.	4283
52.	Himalaya Drug Company, The	966
53.	Hindustan Aeronautics Ltd.	21667
54.	Hindustan Lever Ltd.	4087
55.	Hindustan Motors Ltd. (Auto Division)	614
56.	Hindustan Zinc Ltd.	1491
57.	Hindustan Polymides & Fibres Ltd.,	1280
58.	IPCA Lab. Ltd.	3283
59.	Indian Aluminium Company Ltd.	1018
60.	Indian Oil Corporation Ltd.	10811
61.	Indian Petrochemicals Corporation Ltd.	1005
62.	Indian Telephone Industries Ltd.	3697
63.	Indico Remides Ltd.,	1029
64.	Intas Pharmaceuticals Ltd.	2374
65.	International Tractors Ltd.,	18395
66.	ITC Ltd.	1029
67.	Johnson & Johnson Ltd.	1135
68.	Jubilant Organosys Ltd.	5260
69.	J.B. Chemicals & Pharmaceuticals Ltd.,	797
70.	Kinetic Engineering Ltd.	595
71.	Kirloskar Oil Engine Ltd.	894
72.	Kopran Research Laboratories Ltd.	554
73.	LG Electronics India Pvt. Ltd.	5182
74.	LML Ltd.	1267
75.	Lakshmi Machine Works Ltd.	725

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
76.	Larsen & Toubro Ltd.	3926
77.	Lucas-TVS Ltd.	1182
78.	Lupin Ltd.	14214
79.	MRF Ltd.	988
80.	Maharashtra Hybrid Seeds Company Ltd.	1452
81.	Mahindra & Mahindra Ltd.	12658
82.	Maruti Udyog Ltd.	6710
83.	Matrix Laboratories Ltd.	9210
84.	Micro Labs Ltd.	537
85.	Midas Communication Technologies Pvt. Ltd.	1970
86.	Minda Industries Ltd.	574
87.	MindariKa Pvt. Ltd.	614
88.	Monsanto Holding Pvt. Ltd.	3100
89.	Motor Industries Co. Ltd.	2973
90.	Natco Fine Pharmaceuticals Pvt. Ltd.	506
91.	National Mineral Development Corporation Ltd.	695
92.	National Thermal Power Corporation Ltd.	561
93.	Neuland Laboratories Ltd	2523
94.	Neyveli Lignite Corporation Ltd.	519
95.	Nicholas Piramal Pvt. India Ltd.	10740
96.	Nuziveedu Seeds Ltd.	585
97.	Oil India Ltd.	1112
98.	Orchid Chemicals & Pharmaceuticals Ltd.	6298
99.	Panacea Biotech Ltd.	10721
100.	Pest Control (I) Ltd.	536
101.	Pfizer Ltd.	2119
102.	Pricol Ltd.	1234
103.	Proagro Seed Company Ltd.	724
104.	Proalgen Biotech Ltd.	834
105.	Projects & Development India Ltd., The	790
106.	Punjab Tractors Ltd.	768
107.	Radient Cables Pvt. Ltd.	801
108.	Rallis India Ltd.	1000
109.	Ramco Systems Ltd.	3109
110.	Ranbaxy Laboratories Ltd.	48382
111.	Regent Drug Ltd	2067
112.	Reliance Industries Ltd.	4106
113.	Rolta India Ltd.	537
114.	Sami Lab Ltd.	735

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. in lakhs) *
115.	Samtel Colours Ltd.	1981
116.	Sanmar Speciality Chemicals Ltd.	1688
117.	Semi Conductor Complex Ltd.	502
118.	Shantha Biotechnics Pvt. Ltd.	1200
119.	Shasun Chemical and Drugs Ltd.	2184
120.	Steel Authority of India Ltd.	7190
121.	Secure Meters Ltd.	648
122.	Sundaram Brake Lining Ltd.	519
123.	Sundaram Clayton Ltd.	505
124.	Sun Pharmaceuticals Industries Ltd.	18827
125.	Suven Life Sciences Ltd.	2704
126.	Syngenta India Ltd.	905
127.	TVS Motor Co. Ltd.	1613
128.	Tata Motors Ltd.	47612
129.	Tata Power Co. Ltd.	668
130.	Tata Steel Ltd.,	3372
131.	Tata Consultancy Services (TCS) Ltd.	1042
132.	Tata Tea Ltd.	508
133.	Thirumalai Chemicals Ltd.,	771
134.	The United Phosphorous Ltd.	650
135.	Tractors & Farm Equipment Ltd.	1147
136.	Torrent Pharmaceuticals Ltd.	11214
137.	TVS Motor Co. Ltd.	6149
138.	USV Ltd.	5963
139.	UCAL Fuel Systems Ltd.	1378
140.	Unichem Laboratories Ltd.	2283
141.	Unimark Laboratories Ltd.	5746
142.	Venco Research & Breeding Farm Ltd.	1372
143.	Venkateshwara Research & Breeding Farm (P) Ltd.	537
144.	Videocon International Ltd.	521
145.	Whirlpool of India Ltd.	510
146.	Wipro Ltd.	1370
147.	Wockhardt Ltd.	13774

***** *R&D expenditures reported are as claimed by the firms in their latest available Annual reports in DSIR/renewal applications.*

Annexure 4

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL EXPENDITURE IN THE RANGE OF RS. 100 LAKHS TO RS. 500 LAKHS

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
1.	Aarti Industries Ltd.	183
2.	Ador Welding Ltd.	127
3.	Advanta India Ltd.	191
4.	Aerospace System Pvt. Ltd.	323
5.	Ajanta Pharma Ltd.	113
6.	Ajit Seeds Ltd.	346
7.	Alkali Metals Ltd.	326
8.	Alkyl Amines Chemicals Ltd.	109
9.	Alkam Laboratories Ltd.	364
10.	Amalgam Leather Pvt. Ltd.	283
11.	Amara Raja Batteries Ltd.	123
12.	Amphenol Interconnect India Pvt. Ltd.	160
13.	Amrutanjan Ltd.	113
14.	Amtrex Hitachi Appliances Ltd.	120
15.	Ankur Seeds Pvt. Ltd.	313
16.	Anabond Ltd.	116
17.	Aptech Ltd.	179
18.	Apollo Tyres Ltd.	413
19.	Applied Electro-Magnetics Pvt. Ltd.	157
20.	Arch Pharma Labs Ltd.	100
21.	Ardee Business Services Pvt. Ltd.	114
22.	A S L Advanced System Ltd.,	102
23.	Autometer Alliance Ltd.	176
24.	Avera Laboratories Ltd.	121
25.	Avsarala Tungsten Ltd.	183
26.	Avestha Genguine Technologies Pvt. Ltd.	495
27.	BPL Engineering Ltd.	125
28.	BPL Telecom Ltd.	110
29.	BalaJi Amines Ltd.	340
30.	Bajaj Electricals Ltd.	167
31.	Ballarpur Industries Ltd.	111
32.	Balmer Lawrie & Company Ltd.	252
33.	Balsara Hygine Products Ltd.	124

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
34.	Bangalore Integrated System Solution Pvt. Ltd.	135
35.	Banyan Network Pvt. Ltd.	138
36.	Bata India Ltd.; The	392
37.	Bayer Crop Sciences Ltd.	190
38.	B E L Optronic Devices Ltd.	137
39.	Berger Paints India Ltd.	225
40.	Bharat Dynamics Ltd.	389
41.	Bharat Biotech International Ltd.	400
42.	Bharat Seats Ltd.	132
43.	Bharat Heavy Plate & Vessels Ltd.	141
44.	Bhartia Industries Ltd.	129
45.	Bilag Industries Pvt. Ltd.	102
46.	Biological E. Ltd.	293
47.	Bombay Burmah Trading Corporation Ltd.	132
48.	Britannia Industries Ltd.	132
49.	CMC Computers Ltd.	134
50.	Calyx Chemical & Pharmaceuticals Pvt. Ltd.	244
51.	Camlin Ltd.	194
52.	Camphor & Allied Products Ltd.	147
53.	Carborundum Universal Ltd.	190
54.	Catterpillar India Ltd.	232
55.	Cantaur Chemical Ltd.,	320
56.	Century Textiles & Industries Ltd.	107
57.	Central Electronics Ltd.	260
58.	Ceat Ltd. (Tyre Division)	118
59.	Chandras Chemicals Enterprise Ltd.	101
60.	Chembond Chemicals Ltd.	104
61.	Chennai Petroleum Corporation Ltd.	334
62.	Clariant Chemical (India) Ltd.	324
63.	Claris Life Sciences Ltd.	346
64.	Colour-Chem Ltd.	482
65.	Concept Pharmaceuticals Ltd.	179
66.	Continental Devices of India Ltd.	192
67.	Concord Biotech Ltd.	133
68.	Coral Telecom Ltd.	101
69.	Cosmo Films India Ltd.	205
70.	DCW Ltd.	132
71.	DE-NOCIL Crop Protection Ltd.	216
72.	DGP Hinoday Industries Ltd.	190
73.	DGP Windsor India Ltd.	152

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
74.	Dai-ichi Karkaria Ltd.	355
75.	Deepak Nitrite Ltd.	493
76.	Delphi TVS Diesel System Ltd.	220
77.	Dhampur Sugar Mills Ltd.	296
78.	Dishman Pharmaceutical & Chemical Ltd.	213
79.	Dr. Vithalrao Vikha Patil Sahakari Sakhar Karkhana Ltd.	384
80.	Duke Arnic Electronics Ltd.	108
81.	Dynamatic Technologies Ltd.	232
82.	East India Pharmaceutical Works Ltd.	105
83.	Efftronics System Pvt. Ltd.	107
84.	Elder Pharmaceutical Ltd.	341
85.	Electronic Research Ltd.	131
86.	Elgi Tread (India) Ltd.	208
87.	Elin Electronics Ltd.	106
88.	Emergent Genetics India Pvt. Ltd.	323
89.	Emmellen Biotech Pharmaceuticals Ltd.	181
90.	Encore Software Ltd.	428
91.	Enercon Systems Pvt. Ltd.	100
92.	Eureka Forbes Ltd.	187
93.	Excel Crop Care Ltd.	252
94.	Excel Industries Ltd.	193
95.	Eveready Industries India Ltd.	117
96.	Exide Industries Ltd.	402
97.	Fenner (India) Ltd.	194
98.	Fermenta Biotech Ltd.	223
99.	Fibcom India Ltd.	273
100.	Fortune Biotech Ltd.	204
101.	Foseco India Ltd.	242
102.	Gajra Gears Pvt. Ltd.	103
103.	Gammon India Ltd.	128
104.	Ganga Kaveri Seeds Pvt. Ltd.	191
105.	Garware Polyester Ltd.	215
106.	Garware Wall Ropes Ltd.	188
107.	Genus Overseas Eletronics Ltd.	302
108.	Gland Pharma Ltd.	261
109.	Glaxo Smithkline Pharmaceutical Ltd.	243
110.	Godavari Sugar Mills Ltd	100
111.	Godfrey Philips (India) Ltd.	303
112.	Godrej Agrovet Ltd.	117
113.	Goodlass Nerolac Paints Ltd.	412

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
114.	Grasim Industries Ltd.	138
115.	Gujarat Alkalies & Chemicals Ltd.	222
116.	Gujarat Narmada Valley Fertilisers Co. Ltd.	115
117.	Gulbrandson Chemicals Pvt. Ltd.	237
118.	HBL Nife Power System Ltd.	384
119.	HMT Ltd. (Tractor Division)	145
120.	HMT Machine Tools Ltd.	281
121.	Hargovind Bajaj Research & Development Centre	258
122.	Harita Seating Systems Ltd.	168
123.	Haryana State Electronics Development Corpn. Ltd.	170
124.	Hawkins Cookers Ltd.	108
125.	Heinz India Pvt. Ltd.	412
126.	Hetero Drugs Ltd.	406
127.	Hikal Ltd.	351
128.	High Energy Batteries (I) Ltd.	129
129.	High Polymer Lab.	116
130.	Himalaya Drug Company	257
131.	Hindalco Industries Ltd.	191
132.	Hindustan Antibiotics Ltd.	102
133.	Hindustan Cables Ltd.	207
134.	Hindustan Composites Ltd.	119
135.	Hindustan Construction Company Ltd.	362
136.	Hindustan Copper Ltd.	119
137.	Hindustan Insecticides Ltd.	105
138.	Hindustan Petroleum Corporation Ltd.	204
139.	Hindustan Photo Films Manufacturing Co. Ltd.	101
140.	Hindustan Polyamides & Fibres Ltd.	128
141.	Hindustan Zinc Ltd.	250
142.	Hitachi Home & Life Solutions India Ltd.,	158
143.	Hyderabad Industries Ltd.	122
144.	IBP Company Ltd.	229
145.	Indian Acrylics Ltd.	295
146.	India Glycols Ltd.	192
147.	India Nippon Electricals Ltd.	130
148.	Indian Hume Pipe Ltd.	106
149.	Indian Rare Earth Ltd.	236
150.	India Pistons Ltd.	142
151.	Ind Swift Laboratories Ltd.	458
152.	Ind Swift Ltd.	133
153.	Indo American Hybrid Seeds (India) Ltd.	169

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
154.	Indoco Remedies Ltd.	401
155.	Indofill Chemicals Ltd. (Division of Modipon Ltd.)	220
156.	Indo-National Ltd.	147
157.	Infotech Enterprises Ltd.	114
158.	Innovassynth Technologies (I) Ltd.	154
159.	Ion Exchange (India) Ltd.	205
160.	Jay Hind Industries Ltd.	171
161.	J. Mitra & Co. Ltd.	142
162.	J.B. Chemicals & Pharmaceuticals Ltd.	438
163.	J.K. Agri-Genetics Ltd.	493
164.	Jain Irrigation Systems Ltd.	149
165.	Jindal Steel Power Ltd.	188
166.	Jindal Vijaynagar Steel Ltd.	240
167.	Jyoti Ltd.	312
168.	Jyoti Ceramic Industries Pvt. Ltd.	139
169.	KCP Sugar Industries Corporation Ltd.	421
170.	Kannametal Widia India Ltd.	295
171.	Kasila Farms Ltd.	110
172.	KEC International Ltd.	159
173.	Kerala Minerals & Metals Ltd.	110
174.	Kerala State Electricity Board	142
175.	Kirloskar Brothers Ltd.	171
176.	Kirloskar Copeland Ltd.	262
177.	Kirloskar Electric Co. Ltd.	125
178.	Kirloskar Oil Engines Ltd.	403
179.	Kinetic Engineering Ltd.	303
180.	Kochi Refineries Ltd.	191
181.	Kopran Research Laboratories Ltd.	308
182.	Krishidan Seeds Ltd.	415
183.	L&T Komatsu Ltd.	138
184.	Lamco Industries Pvt. Ltd.	160
185.	Lifecare Innovations (Pvt.) Ltd.	109
186.	Link well Tele System (P) Ltd.	183
187.	Lyka Labs Ltd.	123
188.	MIC Electronics Ltd.	237
189.	MRO-Tek Ltd.	282
190.	MTAR Technologies Pvt. Ltd.	165
191.	Macleods Pharmaceuticals Ltd.	292
192.	Mafatlal Industries Ltd.	268
193.	Malladi Drug and Pharmaceuticals Ltd.	274

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
194.	Manali Petrochemical Ltd.	156
195.	Manugraph India Ltd.	104
196.	Marico Industries Ltd.	240
197.	Mediclone Biotech Pvt. Ltd.	134
198.	Metal Power Company Ltd.	110
199.	Mc-Dowell & Co. Ltd.	355
200.	Midas Communication Technology Pvt. Ltd.	159
201.	Minda Huf Ltd.	227
202.	Mirc Electronics Ltd.	236
203.	Mishra Dhatu Nigam Ltd.	175
204.	Modipon Ltd.	221
205.	Modi Mundipharma Pvt. Ltd	105
206.	Multi Arc India Ltd.	239
207.	NRC Ltd.	155
208.	Nagarjuna Fertilisers & Chemicals Ltd.	176
209.	National Aluminium Company Ltd.	435
210.	Namdhari Seeds Ltd.	201
211.	National Organic Chemical Industries Ltd.	206
212.	Natural Remedies Pvt. Ltd.	270
213.	Newland Laboratories Ltd.	439
214.	Nicco Corpn. Ltd. (Cable Divn.), Calcutta	121
215.	Nirmal Seeds pvt. Ltd.	114
216.	Nunhum Seeds Ltd.	147
217.	O/E/N India Ltd.	102
218.	Otis Elevator Co. (India) Ltd.	123
219.	P I Industries Ltd.	250
220.	Panasonic Batteries India Co. Ltd.	195
221.	Parry Agro Industries Ltd.	140
222.	Pest Control (India) Ltd.	163
223.	Philips Carbon Black Ltd.	129
224.	Pidilite Industries Ltd.	396
225.	Premier Polytronics Pvt. Ltd.	101
226.	Pratista Industries Ltd.	379
227.	RPG Life Sciences Ltd.	422
228.	Radiant Corporation Pvt. Ltd.	295
229.	Rane Brake Linings Ltd.	333
230.	Rane TRW Steering Systems Ltd.,	202
231.	Rasi Seeds Ltd.	112
232.	Rajapalayam Mills Ltd.	187
233.	Raptakos Brett Co. Ltd.	196

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
234.	Rashtriya Chemicals & Fertilizers Ltd.	130
235.	Reva Electric Car Co. Pvt. Ltd.	355
236.	Rubamin Pharmaceuticals Ltd.	125
237.	SRF Ltd.	290
238.	Sai Life Sciences Ltd.,	176
239.	Sakthi Sugar Ltd.	364
240.	Sakata Ink (I) Ltd.	122
241.	Samcor Glass Ltd.	244
242.	Samtel Color Ltd.	115
243.	Sandvik Asia Ltd.	186
244.	Sanmar Speciality Chemicals Ltd.	189
245.	Schenectady-Beck India Ltd.	101
246.	Scooters India Ltd.	112
247.	Sekhsaria Chemicals Ltd.	347
248.	Seminis Vegetables Seeds India Ltd.	294
249.	Shree Cement Ltd.	193
250.	Shreeji Laser Technology Pvt. Ltd.	127
251.	Shriram Pistons & Rings Ltd.	338
252.	Simpson & Co. Ltd.	355
253.	SLN Technologies Pvt. Ltd.	125
254.	SOF Blue Pvt. Ltd.	333
255.	Sona Koyo Steering Systems Ltd.	262
256.	Southern Petrochemical Industries Corpn. Ltd.	332
257.	Spaco Carburettors (India) Ltd.	132
258.	Speck Systems Ltd.	180
259.	Steel Strips Ltd.	128
260.	Sterlite Industries (India) Ltd.	228
261.	Structwell Designers & Consultants Pvt. Ltd.	113
262.	Stesalit Ltd.	135
263.	Sudarshan Biotech Ltd.	160
264.	Sudarshan Chemicals Industries Ltd.	355
265.	Sundaram Fastner Ltd.	356
266.	Swaraj Mazda Ltd.	173
267.	TIL Ltd.	114
268.	TVS Electronics Ltd.	442
269.	TVS Srichakra Ltd.	142
270.	Tablets India Ltd.	164
271.	Tamilnadu Petroproducts Ltd.	280
272.	Tata International Ltd.	102
273.	Tata Refractories Ltd.	206

(Continued)

Sl. No.	Name of the firm	R&D Expenditure Reported (Rs. In lakhs) *
274.	Tata Tea Ltd.	419
275.	Tally Solutions Pvt. Ltd.	262
276.	Tecumesh Products India Ltd.	184
277.	Telco Construction Equipment Company Ltd.	343
278.	Tetra Pak India Pvt. Ltd.	158
279.	Thermax Ltd.	337
280.	Tonira Pharma Ltd.	234
281.	Themis Laboratory Limited	475
282.	The Apex Electricals Ltd.	152
283.	The Dharamsi Morarji Chemical Co. Ltd.,	138
284.	The India Cement Ltd.	128
285.	Thermax Ltd.	338
286.	Tide Water Oil Co. (India) Ltd.	130
287.	Transasia Biomedicals Ltd.	426
288.	Travancore Titanium Products Ltd.	125
289.	Triveni Engineering & Industries Ltd.	169
290.	Tube Products of India (Unit of Tube Investment of India Ltd.)	196
291.	Turbo Engineering Ltd.	228
292.	Tulsi Seeds Pvt. Ltd.	120
293.	United Telecoms Ltd.	311
294.	VIP Industries Ltd.	425
295.	Venkateshwara Hatcheries Ltd.	460
296.	Voltas Ltd.	135
297.	Walchandnagar Industries Ltd.	103
298.	Wanbury Ltd.,	407
299.	Wheels India Ltd.	495
300.	Yuken India Ltd.	178
301.	Zandu Pharmaceuticals Works Ltd.	139
302.	Zen Technologies Ltd.	228
303.	Zenotech Laboratories Ltd.	249

* *R&D expenditures reported are as claimed by the firms in their latest available Annual reports in DSIR/renewal applications.*

Annexure 5

LIST OF SCIENTIFIC & INDUSTRIAL RESEARCH ORGANISATIONS (SIROS) RECOGNIZED DURING THE YEAR 2007

Sl No.	Name of SIROs	Period Valid upto
1.	Swamy Ramananda Tirtha Rural Institute, Nalgonda.	31.03.2009
2.	CBCI Society for Medical Education, Bangalore	31.03.2009
3.	Indo-American Cancer Institute and Research Centre of Nandamuri Basava Taraka Rama Rao Memorial Cancer Foundation and Research Centre, Hyderabad.	31.03.2009
4	Society for Biomedical Technology, Bangalore.	31.03.2009
5.	Herbicure Healthcare Bio-Herbal Research Foundation, Kolkata.	31.03.2009
6.	Koneru Lakshmaiah College of Engineering, Guntur(A.P)	31.03.2009
7.	Shromani Gurudwara Prabhandak Committee's Guru Nank Khalsa College of Arts, Science and commerce, Mumbai.	31.3.2009
8.	Non-Ferrous Materials Technology Development Centre, Hyderabad.	31.3.2009
9.	Society for Operations Research and Training, Vadodara .	31.03.2009
10.	Metabolic Disorders Research Centre, Thiruvananthapuram up to 2010.	31.3.2010
11.	Jeevan Blood Bank and Research Centre, Thiruvananthapuram	31.3.2010
12.	K.S.Rangasamy College of Technology, Namakkal	31.3.2010
13.	Indian Institute of Science Education and Research, Kolkata	31.3.2010
14.	Noorul Islam College of Engineering, Thukalay	31.3.2009
15.	Ramakrishna Mission Residential College, Narendrapur, of Ramakrishna Mission Ashrama, Narendapur, Kolkata	31.3.2009
16.	School of Fundamental Research, Kolkata	31.3.2009
17.	Centre for Natural Biological Resource and Community Development (CNBRCD), Bangalore	31.3.2009
18.	Sinha Institute of Medial Science & Technology, Kolkata	31.3.2010
19.	Kumarappa National Handmade Paper Institute, New Delhi	31.3.2010
20.	Central Council for Research in Unani Medicine, New Delhi	31.3.2010
21.	Sri Ramachandra University, Chennai	31.3.2010
22.	Institute of Mental Hospital & Research Centre, Agra	31.3.2009
23,	R.B.S. College, Agra.	31.3.2010
24.	Kamineni Education Society, Hyderabad	31.3.2009
25.	Asian Healthcare Foundation, Hyderabad	31.3.2010
26.	Balaji Uthan Sansthan, Patna	31.3.2010

Annexure 6

CERTIFICATES FOR CLAIMING ACCELERATED DEPRECIATION ALLOWANCE ISSUED BY DSIR UNDER RULE 5(2) OF THE I.T. RULES VIDE NOTIFICATION NO.133/342/86-TPL DATED 1.4.1987

Sl. No.	Name of the Company	Source of Know-how/ Technology	Item of Manufacture	Investments Certified (Rs. in lakhs)
1.	Transmetal Ltd., Vadodara	In –house R&D center of M/s Transpek Industry Ltd., Vadodara	Tri-chloro Acetyl Chloride.	464.47
2.	High Polymer Labs Ltd., New Delhi	In-house R&D	Anti-oxidants for polyolefins	4184.61
3.	Punjab Tractors Ltd., SAS Nagar, Dist. Ropar	In-house R&D and CMERI, Durgapur.	Agricultural tractors, harvest combines and Industrial forklifts	111.99
4.	Bharat Electronics Ltd., Bangalore	Defence Research & Development Laboratories and In-house R&D.	Electronic equipment and components	1290.81
5.	Aarti Drugs Limited, Mumbai	In-house R&D Centre	Bulk drugs and intermediates	745.82
			Total	**6797.7**

Annexure 7

LIST OF COMMERCIAL R&D COMPANIES APPROVED BY DSIR U/S 80IB(8A) OF IT ACT 1961

1. SIRO Clinpharm Pvt. Ltd
2. Indus Biotherapeutic Pvt. Ltd.
3. Syngene International Pvt. Ltd.
4. Advanced Comfort Systems Pvt. Ltd
5. Metahelix Life sciences Pvt. Ltd
6. Jubilant Biosys Pvt. Ltd
7. AVL Technical Centre Pvt. Ltd,
8. Rubicon Research Pvt. Ltd,
9. S.K.Dynamic Pvt. Ltd
10. Bose Research Pvt. Ltd
11. Bioseed Reseach India Pvt. Ltd.
12. Enem Nostrum Remedies Pvt. Ltd.
13. Rupak Enterprises, Pvt. Ltd.
14. Lambda Therapeutic Research Ltd
15. Dexter Chemicals (I) (P) Ltd
16. S. Zaveri CRO Pvt. Ltd
17. Sci Moleculs India Pvt. Ltd
18. Daftari Agro Biotech Pvt. Ltd.
19. GE India Technology Centre, Pvt. Ltd.
20. Quintiles Research (India) Pvt Ltd
21. Clinigene International Pvt. Ltd
22. Pro Sim Research & Development Pvt. Ltd.
23. Astron Research Ltd.
24. I Cube Nanotec India Pvt. Ltd.
25. Chembiotek Research International Pvt. Ltd
26. Jubilant Chemsys Ltd.
27. Lotus Labs Pvt. Ltd.,
28. Maharashtra Hybrid Seeds Co Ltd,
29. Sipra Labs Limited
30. G V K Bioscience Pvt Ltd
31. Synchron Research Sciences Ltd
32. Research Support International Ltd
33. Sungro Seeds Research Ltd
34. B A Research India Ltd
35. Advinus Therapeutic Pvt Ltd
36. Fine Research and Development Centre Pvt Ltd
37. Actavis Pharma Development Centre Ltd
38. Clinsys India Ltd
39. Orchid Research Laboratory Ltd
40. P I Life Science Research Ltd
41. Aditya Birla Science & Technology Co Ltd
42. Sun Parma Advance Research Laboratories Pvt Ltd
43. Computational Research Laboratories Pvt Ltd
44. Global Transgenes Ltd
45. Fortis Clinical Research Ltd

Annexure 8

LIST OF COMPANIES APPROVED U/S 35(2AB) OF THE INCOME TAX ACT, 1961

1. Aarti Drugs Limited, Thane
2. Ajeet Seeds Ltd., Aurangabad
3. Alembic Ltd., Vadodara
4. Alkali Metals Ltd., Hyderabad
5. Alkem Laboratories Ltd., Mumbai
6. Allied Nippon Ltd., New Delhi
7. Amines and Plasticizers Limited, Mumbai
8. Amoli Organics Pvt. Ltd., Mumbai
9. Anabond Ltd., Chennai
10. Ankur Seeds Pvt. Ltd., Nagpur
11. Aplab Ltd., Thane
12. Arch Pharmalabs Ltd., Mumbai
13. Ardee Business Services Pvt. Ltd., Visakhapatnam
14. Asian Paints Ltd., Mumbai
15. Astra Microwave Products Ltd., Hyderabad
16. Aurobindo Pharma, Hyderabad
17. Auto Ignition Ltd., New Delhi
18. Bajaj Auto Ltd., Pune
19. Bajaj Tempo Ltd., Pune
20. Bal Pharma Ltd., Bangalore
21. Bejo Sheetal Seeds Pvt. Ltd., Jalna
22. Bharat Biotech International Ltd., Hyderabad
23. Bharat Electronics Ltd., Bangalore
24. Bharat Forge Ltd., Pune
25. Bharat Seats Ltd., New Delhi
26. Bhat Bio-Tech India Pvt. Ltd., Bangalore
27. Biocon Ltd., Bangalore
28. Biological E. Ltd., Hyderabad
29. Bio-Med Pvt. Ltd., Ghaziabad
30. Brakes India Ltd., Chennai
31. Cadila Health Care Ltd., Ahmedabad
32. Cadila Pharmaceuticals Ltd., Ahmedabad
33. Calyx Chemicals & Pharmaceuticals Ltd., Mumbai
34. Canpex Chemicals Pvt. Ltd., Pune
35. Celestial Labs Ltd., Hyderabad
36. Centaur Chemicals Pv. Ltd., Mumbai
37. Centaur Pharmaceuticals Pv. Ltd., Mumbai
38. Cipla Ltd., Mumbai
39. Claris Lifesciences Ltd., Ahmedabad
40. Comed Chemicals Ltd., Vadodara
41. Concept Pharmaceuticals Ltd., Mumbai
42. Concord Biotech Ltd., Ahmedabad
43. Conzerv Systems Pvt. Ltd., Bangalore
44. Crompton Greaves Ltd., Mumbai
45. Deepak Nitrite Ltd., Pune
46. Delphi-TVS Diesel Systems Ltd., Chennai
47. DIC India Ltd., Kolkata
48. D-LINK (India) Ltd., Mumbai
49. Dr. Reddy's Labs Ltd., Hyderabad
50. Eicher Motors Ltd., New Delhi
51. Elder Pharma Ltd., Mumbai
52. Elico Ltd., Hyderabad
53. Endurance Systems (India) Pvt. Ltd., Aurangabad
54. Endurance Technologies Private Ltd., Aurangabad
55. Excel Crop Care Ltd., Mumbai
56. FDC Ltd., Aurangabad
57. Fibcom India Ltd., New Delhi
58. Genus Overseas Electronics Ltd., Jaipur
59. Glenmark Pharmaceuticals Ltd., Mumbai
60. Grauer & Weil (India) Ltd., Mumbai
61. Green Gold Seeds Ltd., Aurangabad
62. Gujarat Narmada Valley Fertilizers Company Ltd., Bharuch
63. Harita Seating Systems Ltd., Chennai
64. Hetero Drugs Ltd., Hyderabad
65. High Polymer Labs Ltd., New Delhi
66. Hindustan Polyamides & Fibres Ltd., Mumbai
67. Hyderabad Chemical Supplies Ltd., Hyderabad
68. Ideal Cures Pvt. Ltd., Mumbai-
69. India Japan Lighting Pvt. Ltd., Chennai
70. India Nippon Electricals Ltd., Chennai
71. India Pistons Ltd., Chennai
72. Indian Toners & Developers Ltd., New Delhi
73. Indoco Remedies Ltd., Mumbai
74. Intas Pharmaceuticals Ltd., Ahmedabad
75. International Tractors Ltd., New Delhi
76. IP Rings Ltd., Chennai
77. IPCA Laboratories Ltd., Mumbai
78. J.B.Chem & Pharma Ltd., Mumbai
79. J.Mitra & Co. Ltd., New Delhi
80. Jayant Oils & Devatives Ltd., Mumbai
81. Jubilant Organosys, Noida
82. Kansai Nerolac Paints Limited, Mumbai
83. Kemin Nutritional Technologies (India) Pvt. Ltd., Gummidipoondi
84. Kumar Organic Products Pvt. Ltd., Bangalore
85. LG Electronics India Pvt. Ltd.Greater, Noida
86. Linkwell Telesystems Ltd., Secunderabad

87. Lucas TVS Ltd.Chennai
88. Lupin Ltd., Mumbai
89. Lupin Ltd. Mandideep, Mumbai
90. Madhu Silica Pvt. Ltd., Bhavnagar
91. Mahindra & Mahindra Ltd., Mumbai
92. Maruti Udyog Ltd., New Delhi
93. Matrix Laboratories Ltd., Secunderabad
94. Medha Servo Drives Pvt. Ltd., Hyderabad
95. Mediclone Biotech (P) Ltd., Chennai
96. Medreich Ltd., Bangalore
97. Metropolitan Eximchem Ltd., Mumbai
98. MIC Electronics Ltd., Hyderabad
99. Micro Labs Ltd., Bangalore
100. Minda Huf Ltd., Delhi
101. Minda Industries Ltd., Delhi
102. Modi Mundipharma Private Ltd., New Delhi
103. Morex Petrochem Ltd., Mumbai
104. Motor Industries Co. Ltd., Bangalore
105. MRO-Tec. Ltd.Bangalore
106. Nagarjuna Fertilisers and Chemicals Ltd., Hyderabad
107. Nasan Medicals, Goa
108. Neuland Laboratories Ltd., Hyderabad
109. Orchid Chemicals & Pharmaceuticals Ltd., Chennai
110. Organica Aromatics (Bangalore) Pvt. Ltd., Bangalore
111. Panacea Biotec Ltd., New Delhi
112. Parabolic Drugs Ltd., Chandigarh
113. Praj Industries Ltd., Pune
114. Pricol Ltd., Coimbatore
115. Promed Exports Pvt. Ltd., New Delhi
116. Punjab Tractors Ltd., Ropar
117. Pyrotech Electronics Pvt. Ltd., Udaipur
118. Radiant Cables Private Ltd., Hyderabad
119. Rajasthan Electronics & Instruments Ltd., Jaipur
120. Ramco Systems Ltd., Chennai
121. Ranbaxy Laboratories Ltd., Gurgaon
122. Rane (Madras) Limited, Chennai
123. Rane Brake Linings Ltd., Chennai
124. Rane Madras, Chennai
125. Rane TRW Steering Systems Ltd., Chennai
126. Raptakos, Brett & Co. Ltd., Mumbai
127. Rasi Seeds (P) Ltd., Attur
128. Reliance Cellulose Products Ltd., Secunderabad
129. Resil Chemicals Pvt. Ltd., Bangalore
130. Rico Auto Industries Ltd., Dharuhera
131. Roots Industries Ltd., Coimbator
132. RPG Life Sciences Ltd., Mumbai
133. S.M. Creative Electronics Ltd., New Delhi
134. Sagas Autotec Pvt. Ltd., Mysore
135. Sami Labs Ltd., Bangalore
136. Samtel Color Ltd., New Delhi
137. Sanden Vikas (India) Pvt. Ltd., New Delhi
138. SBL Pvt. Ltd., New Delhi
139. Shantha Biotechnics Pvt. Ltd., Hyderabad
140. Sharda Motor Industries Ltd., New Delhi
141. Shasun Chem. & Drug Ltd., Chennai
142. Simpson & Co. Ltd., Chennai
143. Smruthi Organics Ltd., Solapur
144. SMS Pharmaceuticals Ltd., Hyderabad
145. Sona Koyo Steering Systems Ltd., Gurgaon
146. Sonodyne International Ltd., Kolkata
147. Speck Systems Ltd., Hyderabad
148. SRF Ltd., New Delhi
149. Steel Strips Wheels Ltd., Chandigarh
150. Sterlite Optical Technologies Ltd., Aurangabad
151. Strides Arcolab Ltd., Bangalore
152. Subros Ltd., New Delhi
153. Sudarshan Chemical Ind Ltd., Pune
154. Sun Pharmaceutical Industries Ltd., Vadodara
155. Sunbeam Auto Ltd., Gurgaon
156. Sundaram Clayton Ltd., Chennai
157. Sundram Fasteners Ltd., Chennai
158. Suven Lifesciences Ltd., Hyderabad
159. TAFE Motors & Tractors Ltd., Chennai
160. Tata Motors Ltd., Mumbai
161. The Tata Power Company Ltd., Mumbai
162. Themis Laboratories Pvt. Ltd., Mumbai
163. Thirumalai Chemicals Ltd., Mumbai
164. Torrent Pharmaceticals Ltd., Ahmedabad
165. Tractors and Farm Equipment Ltd.Chennai
166. Transpek-Silox Industry Ltd., Vadodara
167. TTL Ltd., Delhi
168. Turbo Energy Ltd., Chennai
169. TVS Electronics Ltd., Chennai
170. TVS Motor Company Ltd., Chennai
171. Ucal Fuel Systems Ltd., Chennai
172. Unichem Laboratories Ltd., Mumbai
173. USV Ltd., Mumbai
174. Wanbury Ltd., Navi Mumbai
175. WeP Peripherals Ltd., Bangalore
176. Wheels India Ltd., Chennai
177. Wockhardt Ltd., Mumbai
178. Zen Technologies Ltd., Secunderabad

Annexure 9

LIST OF TDDP RUNNING PROJECTS

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
1	DEVELOPMENT OF HIGH SENSITIVITY PHOTO CATHODE FOR 18 MM SUPER GEN IMAGE INTENSIFIER TUBES	BEL OPTRONIC DEVICES LTD.(EARLIER -BE-DELFT ELECTRONICS LTD., PUNE, EL-30, JBLOCK, BHOSARI INDUSTRIAL AREA, PUNE-411026	71	353
2	DEVELOPMENT OF FRAUD MANAGEMENT AND CONTROL CENTRE(FMCC)	MIC ELECTRONICS LIMITED, A-4, ELECTRONIC COMPLEX, KUSHAIGUDA, HYDERABAD-500 062	33	77
3	DEVELOPMENT OF STM-1 BASED CUSTOMER PREMISES EQUIPMENT	CORAL TELECOM AND NETAJI SUBHAS INSTITUTE OF TECHNOLOGY	80	227
4	DEV. OF FULLY AUTOMATED HIGH SPEED BLOOD CHEMISTRY ANALYSER, MODEL X L-100	TRANSASIA BIOMEDICALS LTD., MUMBAI	90	226
5	DEVELOPENT OF TUNABLE TELEMETRY RECEIVER	PARK CONTROLS AND COMMUNICATION LTD., 22,80 FEET ROAD HAL 3RD STAGE, BANGALORE-560075	125	365
6	DEVELOPMENT OF SPECIAL VERSION OF LOW LOSS RF, DATA BUS ELECTRONIC WIRES AND CABLES, LASER MARKED LOOM ASSEMBLIES AND CABLE HARDNESSES FOR EW SYSTEMS, MARINE APPLICATIONS AND AEROSAPCE APPLICATIONS	RADIANT CABLES PVT. LTD., B-1, INDUSTRIAL ESTATE, SANATHNAGAR,HYDERABAD-500018	62	137
7	DEVELOPMENT OF HIGHER DIMENSIONAL CORD WIRE A HIGH STUD WIRE FEEDER	ARDEE BUSINESS SERVICE PVT. LTD., BB-8, CVIL TENT SHOP ROORKELA-769004	70	184
8	DEVELOPMENT OF PIEZOELECTRICALLY ACTUATED MICRO MECHENICAL SWITCH OF RF APPLICATIONS	BHARAT ELECTRONICS LTD., BANGALORE	20	50
9	DEVELOPMENT OF KNEE JOINT, HIP JOINT, SHOULDER JOINT & ELBOW JOINT	POONA HEALTH SERVICES PVT. LTD, SANCHHETI	120	290
10	DEVELOPMENT OF UPGRADED DIGITAL VOICE LOGGER WITH 32 CHANNELS,E1 AND FAX COMPATIBILITY	ABACUS SOFTECH LTD., A-85(2ND FLOOR, EAST OF KAILASH, NEW DELHI-110065	75	215
11	DEVELOPMENT AND DEMONSTRATION OF HIGH ENERGY DENSITY VALVE-REGULATED LEAD-ACID BATTERIES FOR ELECTRIC VEHICLES	NED ENERGY LIMITED, 6-3-1109/1,NAVBHARAT CHAMBERS, RAJ BHAVAN ROAD HYDERABAD-500082 AND INDIAN INSTITUTE OF SCIENCE, BANGALORE	46	121

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
12	DESIGNING AND DEVELOPING THE TECHNOLOGY FOR MANUFACTURING OF EHV COMPOSITE INSULATOR FOR APPLICATION IN 132KV,22KV & 400KV ELECTRIC POWER T&D LINE.	GOLDSTONE TELESEVICES LIMITED, AMARCHAND SHARMA COMPLEX, S.D.ROAD,SECUNDERABAD-500 003	200	404
13	DEVELOPMENT OF DIGITAL RADIO RELAY SYSTEM	HBL NIFE POWER SYSTEM LIMITED, 8-2-601,ROAD NO.10, BANJARA HILLS, HYDERABAD-500034	154	458
14	DEV OF 6 DOF ELECTRICAL MOTION PLATOFRM	ZEN TECHNOLOGIES LIMITED, B-42, INDUSTRAIL ESTATE, SANATH NAGAR, HYDERABAD 500018 AND ,	200	467
15	DEVELOPMENT OF UNIQUE DEROVO DRUG DESIGN TOOL	CELESTRICAL LABS LTD, PLOTS 235A, ROAD NO36,JUBLEE HALL,HYDERABAD-500033	75	291
16	ANIMAL IDENTIFICATION SYSTEM THROUGH RFID	RAJASTHAN ELECTRONICS & INSTRUMENTS LTD., 2,KANKPURA INDUSTRIAL AREA, JAIPUR-302012	20	53
17	DEVELOPMENT OF OPTICAL TIME DOMAIN REBLECTOMETER(OTDR)	AISWARYA TELECOM, PVT. LTD. 3C, PAMRAT COMMERCIAL COMPLEX OPP:AG OFFICE SIFLERD, HYDERABAD-4	35	87
18	DEVELOPMENT OF A LEARNING CONTENT MANAGEMENT SYSTEM(LCMS) WITH AN INTELLIGENT AUTHORITY TOOL	APTECH LIMITED, IT 1&2,SDF VII, SEEPZ, ANDHERI(E), MUMBAI-400093 AND IIIT,ALLAHABAD	60	260
19	DEVELOPMENT OF CTI(COMPUTER TELEPHONY INTEGRATION) BASED CALL CENTRE SOFTWARE	SM TELESYS LTD(SMTL), A-51,SECTOR-8,NOIDA(UP)-201 301 AND SRI ATAL BIHARI VAJPAYEE INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT(IIITM)	30	85
20	DEV. OF MEMBRANE TECHNOLOGY FOR NATURAL GAS SEPARATION	ENGINEERS INDIA LTD., ENGINEERS INDIA BHAVAN; 1, BHIKAJI CAMA PLACE; NEW DELHI - 110 066 AND O N G C, HAZIRA & I I C T HYDERABAD	42	148
21	CAST DESIGN SYSTEM FOR AIDING IN THE INTELLIGENT COMPUER AIDED DESIGN OF CASTINGS	ORIENT SOFTWARE PVT. LTD.,, BANGALORE AND INDIAN INSTITUTE OF SCIENCE, SCIENCE P. O., BANGALORE - 560 012	25	54
22	DEVELOPMENT AD DEMONSTRATION OF 'POLYMERIC FATLIQORS' FOR UPHOLSTERY LEATHER UNDER TECHNOLOGY DEVELOPMENT & INNOVATION PROGRAMME	HARYANA LEATHER CHEMICALS LIMITED, 1004, BHIKAJI CAMA BHAWAN, BHIKAJI CAMA PLACE, NEW DELHI-110 066	75	228
23	ESTABLISHING BIO CNOTROL AGENT PRODUCTION UNIT	T.STANES AND COMPNANY LIMITED, 8/23-24,RACE COURSE ROAD, COIMBATORE-641018	180	375

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
24	CONTROL OF PSYCHROPHILIC AND PSYCHROTROPHIC FOOD SPOILAGE MICROORGANISMS IN COLD STORAGES- AN ECOFRIENDLY APPROACH	M/S SCHEVARAN LABORATORIES PVT. LTD, MYSORE, 427/B,HEBBAL INDUSTRIAL AREA, METAGALLY POST, MYSORE-571186 AND C F T R I , MYSORE	8	23
25	DESIGN, DEVELOPMET, AND DEMONSTRATION OF INNOVATIVE EQUIPMENT FOR IMPROVED ORGANIC MANURE PROCESS FROM MUNICIPAL SOLID WATE AT A PILOT SCALE	BULL MACHINE(PVT) LIMITED, S.F.NO. 5/1-A, TRICHY ROAD, L&T BYEPASS JN., CHINTHAMANI PUDUR POST, COIMBATORE-641103 AND NIL	85	196
26	DESIGN, DEV. AND MANUFACTURE OF (1) 5¾ DIGIT MULTIMETER, (2) 6¾ DIGIT MULTIMETER	RISHABH INSTRUMENTS (P) LTD., PLOT NO. F-31, M I D C SATPUR, NASHIK - 422 007	55	136
27	DEVELOPMENT OF FLAME RETARDANT LOW SMOKE MATERIAL FOR WIRES AND CABLESFOR SHORTING APPLICATIONS	FARCOM CABLE SYSTEMS (P) LTD., OVER TANNARY ROAD,BANGALORE-560045,[NO. 26, 6TH CROSS, P.B. NO. 171, VASANTHNAGAR, BANGALORE -560 052, KARNATAKA AND CENTRAL POWER RESEARCH INSTITUTE, NEW B E L ROAD, P. B. NO. 9401, BANGALORE - 560 094, KARNATAKA	38	105
28	INTEGRATED PILOT DEMONSTRATION PLANT FOR FRUIT PROCESSING	MANAGEMENT OF TRIBAL AREA FOUNDATION, MATA FOUNDATION,IMPHAL, NEW DELHI AND C F T R I, MYSORE, MYSORE	100	320
29	DEVELOPMENT AND TESTING OF MINI DRY H CL GAS COTTON SEED DELINTING PLANT.	MAHARASHTRA STATE SEEDS CORPORATION LTD., AKOLA-444 001 AND I I T, POWAI, BOMBAY	31	93
30	DESIGN AND MANUFACTURE OF PROTOTYPE CERAMIC MEMBRANE FILTRATION UNIT FOR PRODUCTION OF SAFE DOMESTIC DRINKING WATER	BHARAT HEAVY ELECTRICALS LTD.,, CERAMIC BUSINESS UNIT, P. B. NO. 1245, I I SC. POST, BANGALORE - 560 012 AND CERAMIC TECHNOLOGICAL INSTT. & N C L, P. B. NO. 1245, BANGALORE - 560 012 & DR. HOMI BHABHA RD., PUNE - 411 018	70	149
31	DEVELOPMENT TO COMPLETE THE R A D A R LEVEL GAUGING SYSTEMS	S. B. ELECTRO - MECHANICALS (P) LTD., PUNE	16	35
32	TECHNOLOGY DEMONSTRATION PROJECT FOR TEST ROADSTRETCH USING MARBLE SLURRY DUST IN KOTELA VILLAGE OF RAJSAMAND DISTRICT UNDER DISTRICT POVERTY INITIATIVE PROJECT(DPIP)	UDAIPUR CHAMBER OF COMMERECE AND INDUSTRY(UCCI),UDAIPUR AND CENTRAL ROAD RESEARCH INSTITUTE(CRRI)	9	20

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
33	CONCEPTUAL STUDIES ON LIGHTER-THAN-AIR VEHICLE (LTAV) SYSTEM FOR TOURISM AS WELL AS AIR FRRY ACROSS RIVER BANKS IN NER	NATIONAL AEROSPACE LABORATORIESL, BANGALORE AND IIT B, BOMBAY	10	10
34	DEVELOPMENT OF A S I C BASED ENERGY METER	BHARAT HEAVY ELECTRICALS LTD.,, ELECTRONICS DIVISION, MYSORE ROAD, BANGALORE 560 026, KARNATAKA AND SEMICONDUCTOR COMPLEX LTD., CHANDIGARH	23	46
35	"PROCESS DEVELOPMENT FOR THE MANUFACTURE OF 3-AMINO-3AZABICYCLO [3.3.0] OCTANE"	BAL PHARMA LTD., BANGALORE, BAL PHARMA LTD., 21&22, BOMMASANDRA INDUSTRIAL AREA, BANGALORE - 560 099 AND NIL, NIL	50	150
36	IDENTIFICATION DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM FOREST PLANTS/WEEDS AND AGRICULTURAL WASTE	SIKKIM KHADI & VILLAGE INDUSTRIES BOARD, SIKKIM AND FOREST REASEARCH INSTITUTE(FRI), DEHRADUN	58	134
37	DEVELOPMENT OF INACTIVATED VACCINE USING NATIVE ISOLATES OF MYCOBACTERIUM AVIUM SUBSP. PARATUBERCULOSIS AGAINST JOHNE'S DISEASE IN GOATS AND SHEEP	CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA, 1ST FLOOR, GOPI COMPLEX, DHOLI PYAU, MATHURA(U.P.)-281001 AND CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA-281122	8	16
38	DEVELOPMNT OF ACTIVE PHARMACEUTICAL INGREDIENTS(API),API INTERMEDIATES,METAL ACETYLACETONATES	M/S SMS PHARMACEUTICALS LIMITED, INDUSTRIAL ESTATE, KAZIPALLI VILLAGE, JINNARAM MANDAL, MEDAK DT. PIN-502319 AND INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY(IICT)	135	475
39	DEVELOPMENT OF PROCESS FOR MANUFACTURING OF 1 BROMO 3-CHLORO PROPANE(B.C.P) & 1,3 DIBROMO PROPANE(D.B.P) IN PILOT PLANT	ANU'S LABORATORIES LTD., A49, MADHURANAGAR, VENGALRAONAGAR, HYDERABAD,A.P.-500038 AND KOBE ENTERPRISES, GEETA APPARTMENTS, SANTOSHNAGAR, MEHDIPATNAM, HYDERABAD	64	130
40	DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM THE FOREST PLANTS OF UTTRANCHAL	FOREST RESEARCH INSTITUTE, PO.-NEW FOREST, DEHRADUN-248006	50	61
41	DEVELOPMENT OF PROCESS FOR THE MANUFACTURE OF ETHYL 2(2-AMINOTHIAZOL-4-YL)-2- METHOXYIMINOACETATE AND 2-FORMYLAMINO-4-THIAZOLE ACETIC ACID ETHYL ESTER IN PILOT PLANT	PUNJAB CHEMICALS & PHARMACEUTICALS LTD., 107,ANSAL BHAWAN, KG ROAD, NEW DELHI-110 001 AND M/S PROCESS DESIGN & ENGINEERING COMPANY CONSULTANTS, CHANDIGARH	65	141

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
42	DEVELOPMENT OF POLYMORPHIC FORMI CLOPIDOGREL BISULPHAE	M/S ARCH PHARMALABS LTD, 'H' WING, 4TH FLOOR, TAX CENTRE, OFF SAKI VIHAR ROAD,CHANDIVALI, ANDHERI(E), MUMBAI-400072 AND ,	40	105
43	DEVELOPING A COMMERICAL PRODUCT FOR THALASSEMIA - THE BASIC TECHNOLOGY	FDC LIMITED, 142-48, S.V> ROAD,	40	80
44	DEVELOPMENT OF AN IMPROVED TILTING DISC HEART VALVE PROSTHESIS	T T K HEALTHCARE LIMITED, 6,CATHEDRAL ROAD,CHENNAI-600086 AND SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY, BIOMEDICAL TECHNOLOGY WING, SATEMOND PALACE, POOJAPPURA,THRIUVANANTHAPURAM-695012	40	90
45	DEVELOPMENT OF DIGITAL AXLE COUNTER	CENTRAL ELECTRONICS LTD., SAHIBABAD, 4, INDUSTRIAL AREA,SAUR URJA MARG, SAHIBABAD-201010, UP	70	146
46	DEV. OF ENERGY EFFICIENT FAN SYSTEM	PARAG FANS AND COOLING SYSTEMS LTD.,	28	72
47	DEVELOPMENT AND DEMONSTRATION OF TECHNOLOGY OF CONTINUOUS HYDROGENATION OF FATTY ACIDS AND OLEO CHEMICAL PLANTS	MECPRO HEAVY ENGINEERING LIMITED, 610,SOM DATT CHAMBER-II, BHIKAJI CAMA PLACE , NEW DELHI-110066	70	145
48	DEVELOPMENT OF TECHNOLOGY AND VALIDATION OF DESIGN METHODOLOGY OF MANUFACTURE OF ENERGY EFFICIENT PUMPS	PROCESS PUMPS(I) PVT. LTD., PLOT NO.86,III PHASE, PEENYA INDUSTRIAL AREA,BANGALORE-560 058 AND DEPT. OF MECHNICAL EBGG, IISC, BANGALORE-560 012	14	48
49	DEV. OF TECH. AND EQUIPMENT FOR PRODUCTION OF LARGE DIAMETER STONEWARE/ VITRIFIED CLAY PIPES	PRIYA KLAY (P) LTD., NEW DELHI	60	148

Annexure 9

LIST OF TDDP RUNNING PROJECTS

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
1	DEVELOPMENT OF HIGH SENSITIVITY PHOTO CATHODE FOR 18 MM SUPER GEN IMAGE INTENSIFIER TUBES	BEL OPTRONIC DEVICES LTD.(EARLIER -BE-DELFT ELECTRONICS LTD., PUNE, EL-30, JBLOCK, BHOSARI INDUSTRIAL AREA, PUNE-411026	71	353
2	DEVELOPMENT OF FRAUD MANAGEMENT AND CONTROL CENTRE(FMCC)	MIC ELECTRONICS LIMITED, A-4, ELECTRONIC COMPLEX, KUSHAIGUDA, HYDERABAD-500 062	33	77
3	DEVELOPMENT OF STM-1 BASED CUSTOMER PREMISES EQUIPMENT	CORAL TELECOM AND NETAJI SUBHAS INSTITUTE OF TECHNOLOGY	80	227
4	DEV. OF FULLY AUTOMATED HIGH SPEED BLOOD CHEMISTRY ANALYSER, MODEL X L-100	TRANSASIA BIOMEDICALS LTD., MUMBAI	90	226
5	DEVELOPENT OF TUNABLE TELEMETRY RECEIVER	PARK CONTROLS AND COMMUNICATION LTD., 22,80 FEET ROAD HAL 3RD STAGE, BANGALORE-560075	125	365
6	DEVELOPMENT OF SPECIAL VERSION OF LOW LOSS RF, DATA BUS ELECTRONIC WIRES AND CABLES, LASER MARKED LOOM ASSEMBLIES AND CABLE HARDNESSES FOR EW SYSTEMS, MARINE APPLICATIONS AND AEROSAPCE APPLICATIONS	RADIANT CABLES PVT. LTD., B-1, INDUSTRIAL ESTATE, SANATHNAGAR,HYDERABAD-500018	62	137
7	DEVELOPMENT OF HIGHER DIMENSIONAL CORD WIRE A HIGH STUD WIRE FEEDER	ARDEE BUSINESS SERVICE PVT. LTD., BB-8, CVIL TENT SHOP ROORKELA-769004	70	184
8	DEVELOPMENT OF PIEZOELECTRICALLY ACTUATED MICRO MECHENICAL SWITCH OF RF APPLICATIONS	BHARAT ELECTRONICS LTD., BANGALORE	20	50
9	DEVELOPMENT OF KNEE JOINT, HIP JOINT, SHOULDER JOINT & ELBOW JOINT	POONA HEALTH SERVICES PVT. LTD, SANCHHETI	120	290
10	DEVELOPMENT OF UPGRADED DIGITAL VOICE LOGGER WITH 32 CHANNELS,E1 AND FAX COMPATIBILITY	ABACUS SOFTECH LTD., A-85(2ND FLOOR, EAST OF KAILASH, NEW DELHI-110065	75	215
11	DEVELOPMENT AND DEMONSTRATION OF HIGH ENERGY DENSITY VALVE-REGULATED LEAD-ACID BATTERIES FOR ELECTRIC VEHICLES	NED ENERGY LIMITED, 6-3-1109/1,NAVBHARAT CHAMBERS, RAJ BHAVAN ROAD HYDERABAD-500082 AND INDIAN INSTITUTE OF SCIENCE, BANGALORE	46	121

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
12	DESIGNING AND DEVELOPING THE TECHNOLOGY FOR MANUFACTURING OF EHV COMPOSITE INSULATOR FOR APPLICATION IN 132KV,22KV & 400KV ELECTRIC POWER T&D LINE.	GOLDSTONE TELESEVICES LIMITED, AMARCHAND SHARMA COMPLEX, S.D.ROAD,SECUNDERABAD-500 003	200	404
13	DEVELOPMENT OF DIGITAL RADIO RELAY SYSTEM	HBL NIFE POWER SYSTEM LIMITED, 8-2-601,ROAD NO.10, BANJARA HILLS, HYDERABAD-500034	154	458
14	DEV OF 6 DOF ELECTRICAL MOTION PLATOFRM	ZEN TECHNOLOGIES LIMITED, B-42, INDUSTRAIL ESTATE, SANATH NAGAR, HYDERABAD 500018 AND ,	200	467
15	DEVELOPMENT OF UNIQUE DEROVO DRUG DESIGN TOOL	CELESTRICAL LABS LTD, PLOTS 235A, ROAD NO36,JUBLEE HALL,HYDERABAD-500033	75	291
16	ANIMAL IDENTIFICATION SYSTEM THROUGH RFID	RAJASTHAN ELECTRONICS & INSTRUMENTS LTD., 2,KANKPURA INDUSTRIAL AREA, JAIPUR-302012	20	53
17	DEVELOPMENT OF OPTICAL TIME DOMAIN REBLECTOMETER(OTDR)	AISWARYA TELECOM, PVT. LTD. 3C, PAMRAT COMMERCIAL COMPLEX OPP:AG OFFICE SIFLERD, HYDERABAD-4	35	87
18	DEVELOPMENT OF A LEARNING CONTENT MANAGEMENT SYSTEM(LCMS) WITH AN INTELLIGENT AUTHORITY TOOL	APTECH LIMITED, IT 1&2,SDF VII, SEEPZ, ANDHERI(E), MUMBAI-400093 AND IIIT,ALLAHABAD	60	260
19	DEVELOPMENT OF CTI(COMPUTER TELEPHONY INTEGRATION) BASED CALL CENTRE SOFTWARE	SM TELESYS LTD(SMTL), A-51,SECTOR-8,NOIDA(UP)-201 301 AND SRI ATAL BIHARI VAJPAYEE INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT(IIITM)	30	85
20	DEV. OF MEMBRANE TECHNOLOGY FOR NATURAL GAS SEPARATION	ENGINEERS INDIA LTD., ENGINEERS INDIA BHAVAN; 1, BHIKAJI CAMA PLACE; NEW DELHI - 110 066 AND O N G C, HAZIRA & I I C T HYDERABAD	42	148
21	CAST DESIGN SYSTEM FOR AIDING IN THE INTELLIGENT COMPUER AIDED DESIGN OF CASTINGS	ORIENT SOFTWARE PVT. LTD.,, BANGALORE AND INDIAN INSTITUTE OF SCIENCE, SCIENCE P. O., BANGALORE - 560 012	25	54
22	DEVELOPMENT AD DEMONSTRATION OF 'POLYMERIC FATLIQORS' FOR UPHOLSTERY LEATHER UNDER TECHNOLOGY DEVELOPMENT & INNOVATION PROGRAMME	HARYANA LEATHER CHEMICALS LIMITED, 1004, BHIKAJI CAMA BHAWAN, BHIKAJI CAMA PLACE, NEW DELHI-110 066	75	228
23	ESTABLISHING BIO CNOTROL AGENT PRODUCTION UNIT	T.STANES AND COMPNANY LIMITED, 8/23-24,RACE COURSE ROAD, COIMBATORE-641018	180	375

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
24	CONTROL OF PSYCHROPHILIC AND PSYCHROTROPHIC FOOD SPOILAGE MICROORGANISMS IN COLD STORAGES- AN ECOFRIENDLY APPROACH	M/S SCHEVARAN LABORATORIES PVT. LTD, MYSORE, 427/B,HEBBAL INDUSTRIAL AREA, METAGALLY POST, MYSORE-571186 AND C F T R I , MYSORE	8	23
25	DESIGN, DEVELOPMET, AND DEMONSTRATION OF INNOVATIVE EQUIPMENT FOR IMPROVED ORGANIC MANURE PROCESS FROM MUNICIPAL SOLID WATE AT A PILOT SCALE	BULL MACHINE(PVT) LIMITED, S.F.NO. 5/1-A, TRICHY ROAD, L&T BYEPASS JN., CHINTHAMANI PUDUR POST, COIMBATORE-641103 AND NIL	85	196
26	DESIGN, DEV. AND MANUFACTURE OF (1) 5¾ DIGIT MULTIMETER, (2) 6¾ DIGIT MULTIMETER	RISHABH INSTRUMENTS (P) LTD., PLOT NO. F-31, M I D C SATPUR, NASHIK - 422 007	55	136
27	DEVELOPMENT OF FLAME RETARDANT LOW SMOKE MATERIAL FOR WIRES AND CABLESFOR SHORTING APPLICATIONS	FARCOM CABLE SYSTEMS (P) LTD., OVER TANNARY ROAD,BANGALORE-560045,[NO. 26, 6TH CROSS, P.B. NO. 171, VASANTHNAGAR, BANGALORE -560 052, KARNATAKA AND CENTRAL POWER RESEARCH INSTITUTE, NEW B E L ROAD, P. B. NO. 9401, BANGALORE - 560 094, KARNATAKA	38	105
28	INTEGRATED PILOT DEMONSTRATION PLANT FOR FRUIT PROCESSING	MANAGEMENT OF TRIBAL AREA FOUNDATION, MATA FOUNDATION,IMPHAL, NEW DELHI AND C F T R I, MYSORE, MYSORE	100	320
29	DEVELOPMENT AND TESTING OF MINI DRY H CL GAS COTTON SEED DELINTING PLANT.	MAHARASHTRA STATE SEEDS CORPORATION LTD., AKOLA-444 001 AND I I T, POWAI, BOMBAY	31	93
30	DESIGN AND MANUFACTURE OF PROTOTYPE CERAMIC MEMBRANE FILTRATION UNIT FOR PRODUCTION OF SAFE DOMESTIC DRINKING WATER	BHARAT HEAVY ELECTRICALS LTD.,, CERAMIC BUSINESS UNIT, P. B. NO. 1245, I I SC. POST, BANGALORE - 560 012 AND CERAMIC TECHNOLOGICAL INSTT. & N C L, P. B. NO. 1245, BANGALORE - 560 012 & DR. HOMI BHABHA RD., PUNE - 411 018	70	149
31	DEVELOPMENT TO COMPLETE THE R A D A R LEVEL GAUGING SYSTEMS	S. B. ELECTRO - MECHANICALS (P) LTD., PUNE	16	35
32	TECHNOLOGY DEMONSTRATION PROJECT FOR TEST ROADSTRETCH USING MARBLE SLURRY DUST IN KOTELA VILLAGE OF RAJSAMAND DISTRICT UNDER DISTRICT POVERTY INITIATIVE PROJECT(DPIP)	UDAIPUR CHAMBER OF COMMERECE AND INDUSTRY(UCCI),UDAIPUR AND CENTRAL ROAD RESEARCH INSTITUTE(CRRI)	9	20

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
33	CONCEPTUAL STUDIES ON LIGHTER-THAN-AIR VEHICLE (LTAV) SYSTEM FOR TOURISM AS WELL AS AIR FRRY ACROSS RIVER BANKS IN NER	NATIONAL AEROSPACE LABORATORIESL, BANGALORE AND IIT B, BOMBAY	10	10
34	DEVELOPMENT OF A S I C BASED ENERGY METER	BHARAT HEAVY ELECTRICALS LTD.,, ELECTRONICS DIVISION, MYSORE ROAD, BANGALORE 560 026, KARNATAKA AND SEMICONDUCTOR COMPLEX LTD., CHANDIGARH	23	46
35	"PROCESS DEVELOPMENT FOR THE MANUFACTURE OF 3-AMINO-3AZABICYCLO [3.3.0] OCTANE"	BAL PHARMA LTD., BANGALORE, BAL PHARMA LTD., 21&22, BOMMASANDRA INDUSTRIAL AREA, BANGALORE - 560 099 AND NIL, NIL	50	150
36	IDENTIFICATION DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM FOREST PLANTS/WEEDS AND AGRICULTURAL WASTE	SIKKIM KHADI & VILLAGE INDUSTRIES BOARD, SIKKIM AND FOREST REASEARCH INSTITUTE(FRI), DEHRADUN	58	134
37	DEVELOPMENT OF INACTIVATED VACCINE USING NATIVE ISOLATES OF MYCOBACTERIUM AVIUM SUBSP. PARATUBERCULOSIS AGAINST JOHNE'S DISEASE IN GOATS AND SHEEP	CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA, 1ST FLOOR, GOPI COMPLEX, DHOLI PYAU, MATHURA(U.P.)-281001 AND CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA-281122	8	16
38	DEVELOPMNT OF ACTIVE PHARMACEUTICAL INGREDIENTS(API),API INTERMEDIATES,METAL ACETYLACETONATES	M/S SMS PHARMACEUTICALS LIMITED, INDUSTRIAL ESTATE, KAZIPALLI VILLAGE, JINNARAM MANDAL, MEDAK DT. PIN-502319 AND INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY(IICT)	135	475
39	DEVELOPMENT OF PROCESS FOR MANUFACTURING OF 1 BROMO 3-CHLORO PROPANE(B.C.P) & 1,3 DIBROMO PROPANE(D.B.P) IN PILOT PLANT	ANU'S LABORATORIES LTD., A49, MADHURANAGAR, VENGALRAONAGAR, HYDERABAD,A.P.-500038 AND KOBE ENTERPRISES, GEETA APPARTMENTS, SANTOSHNAGAR, MEHDIPATNAM, HYDERABAD	64	130
40	DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM THE FOREST PLANTS OF UTTRANCHAL	FOREST RESEARCH INSTITUTE, PO.-NEW FOREST, DEHRADUN-248006	50	61
41	DEVELOPMENT OF PROCESS FOR THE MANUFACTURE OF ETHYL 2(2-AMINOTHIAZOL-4-YL)-2- METHOXYIMINOACETATE AND 2-FORMYLAMINO-4-THIAZOLE ACETIC ACID ETHYL ESTER IN PILOT PLANT	PUNJAB CHEMICALS & PHARMACEUTICALS LTD., 107,ANSAL BHAWAN, KG ROAD, NEW DELHI-110 001 AND M/S PROCESS DESIGN & ENGINEERING COMPANY CONSULTANTS, CHANDIGARH	65	141

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
42	DEVELOPMENT OF POLYMORPHIC FORMI CLOPIDOGREL BISULPHAE	M/S ARCH PHARMALABS LTD, 'H' WING, 4TH FLOOR, TAX CENTRE, OFF SAKI VIHAR ROAD,CHANDIVALI, ANDHERI(E), MUMBAI-400072 AND ,	40	105
43	DEVELOPING A COMMERICAL PRODUCT FOR THALASSEMIA - THE BASIC TECHNOLOGY	FDC LIMITED, 142-48, S.V> ROAD,	40	80
44	DEVELOPMENT OF AN IMPROVED TILTING DISC HEART VALVE PROSTHESIS	T T K HEALTHCARE LIMITED, 6,CATHEDRAL ROAD,CHENNAI-600086 AND SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY, BIOMEDICAL TECHNOLOGY WING, SATEMOND PALACE, POOJAPPURA,THRIUVANANTHAPURAM-695012	40	90
45	DEVELOPMENT OF DIGITAL AXLE COUNTER	CENTRAL ELECTRONICS LTD., SAHIBABAD, 4, INDUSTRIAL AREA,SAUR URJA MARG, SAHIBABAD-201010, UP	70	146
46	DEV. OF ENERGY EFFICIENT FAN SYSTEM	PARAG FANS AND COOLING SYSTEMS LTD.,	28	72
47	DEVELOPMENT AND DEMONSTRATION OF TECHNOLOGY OF CONTINUOUS HYDROGENATION OF FATTY ACIDS AND OLEO CHEMICAL PLANTS	MECPRO HEAVY ENGINEERING LIMITED, 610,SOM DATT CHAMBER-II, BHIKAJI CAMA PLACE , NEW DELHI-110066	70	145
48	DEVELOPMENT OF TECHNOLOGY AND VALIDATION OF DESIGN METHODOLOGY OF MANUFACTURE OF ENERGY EFFICIENT PUMPS	PROCESS PUMPS(I) PVT. LTD., PLOT NO.86,III PHASE, PEENYA INDUSTRIAL AREA,BANGALORE-560 058 AND DEPT. OF MECHNICAL EBGG, IISC, BANGALORE-560 012	14	48
49	DEV. OF TECH. AND EQUIPMENT FOR PRODUCTION OF LARGE DIAMETER STONEWARE/ VITRIFIED CLAY PIPES	PRIYA KLAY (P) LTD., NEW DELHI	60	148

Annexure 9

LIST OF TDDP RUNNING PROJECTS

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
1	DEVELOPMENT OF HIGH SENSITIVITY PHOTO CATHODE FOR 18 MM SUPER GEN IMAGE INTENSIFIER TUBES	BEL OPTRONIC DEVICES LTD.(EARLIER -BE-DELFT ELECTRONICS LTD., PUNE, EL-30, JBLOCK, BHOSARI INDUSTRIAL AREA, PUNE-411026	71	353
2	DEVELOPMENT OF FRAUD MANAGEMENT AND CONTROL CENTRE(FMCC)	MIC ELECTRONICS LIMITED, A-4, ELECTRONIC COMPLEX, KUSHAIGUDA, HYDERABAD-500 062	33	77
3	DEVELOPMENT OF STM-1 BASED CUSTOMER PREMISES EQUIPMENT	CORAL TELECOM AND NETAJI SUBHAS INSTITUTE OF TECHNOLOGY	80	227
4	DEV. OF FULLY AUTOMATED HIGH SPEED BLOOD CHEMISTRY ANALYSER, MODEL X L-100	TRANSASIA BIOMEDICALS LTD., MUMBAI	90	226
5	DEVELOPENT OF TUNABLE TELEMETRY RECEIVER	PARK CONTROLS AND COMMUNICATION LTD., 22,80 FEET ROAD HAL 3RD STAGE, BANGALORE-560075	125	365
6	DEVELOPMENT OF SPECIAL VERSION OF LOW LOSS RF, DATA BUS ELECTRONIC WIRES AND CABLES, LASER MARKED LOOM ASSEMBLIES AND CABLE HARDNESSES FOR EW SYSTEMS, MARINE APPLICATIONS AND AEROSAPCE APPLICATIONS	RADIANT CABLES PVT. LTD., B-1, INDUSTRIAL ESTATE, SANATHNAGAR,HYDERABAD-500018	62	137
7	DEVELOPMENT OF HIGHER DIMENSIONAL CORD WIRE A HIGH STUD WIRE FEEDER	ARDEE BUSINESS SERVICE PVT. LTD., BB-8, CVIL TENT SHOP ROORKELA-769004	70	184
8	DEVELOPMENT OF PIEZOELECTRICALLY ACTUATED MICRO MECHENICAL SWITCH OF RF APPLICATIONS	BHARAT ELECTRONICS LTD., BANGALORE	20	50
9	DEVELOPMENT OF KNEE JOINT, HIP JOINT, SHOULDER JOINT & ELBOW JOINT	POONA HEALTH SERVICES PVT. LTD, SANCHHETI	120	290
10	DEVELOPMENT OF UPGRADED DIGITAL VOICE LOGGER WITH 32 CHANNELS,E1 AND FAX COMPATIBILITY	ABACUS SOFTECH LTD., A-85(2ND FLOOR, EAST OF KAILASH, NEW DELHI-110065	75	215
11	DEVELOPMENT AND DEMONSTRATION OF HIGH ENERGY DENSITY VALVE-REGULATED LEAD-ACID BATTERIES FOR ELECTRIC VEHICLES	NED ENERGY LIMITED, 6-3-1109/1,NAVBHARAT CHAMBERS, RAJ BHAVAN ROAD HYDERABAD-500082 AND INDIAN INSTITUTE OF SCIENCE, BANGALORE	46	121

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
12	DESIGNING AND DEVELOPING THE TECHNOLOGY FOR MANUFACTURING OF EHV COMPOSITE INSULATOR FOR APPLICATION IN 132KV,22KV & 400KV ELECTRIC POWER T&D LINE.	GOLDSTONE TELESEVICES LIMITED, AMARCHAND SHARMA COMPLEX, S.D.ROAD,SECUNDERABAD-500 003	200	404
13	DEVELOPMENT OF DIGITAL RADIO RELAY SYSTEM	HBL NIFE POWER SYSTEM LIMITED, 8-2-601,ROAD NO.10, BANJARA HILLS, HYDERABAD-500034	154	458
14	DEV OF 6 DOF ELECTRICAL MOTION PLATOFRM	ZEN TECHNOLOGIES LIMITED, B-42, INDUSTRAIL ESTATE, SANATH NAGAR, HYDERABAD 500018 AND ,	200	467
15	DEVELOPMENT OF UNIQUE DEROVO DRUG DESIGN TOOL	CELESTRICAL LABS LTD, PLOTS 235A, ROAD NO36,JUBLEE HALL,HYDERABAD-500033	75	291
16	ANIMAL IDENTIFICATION SYSTEM THROUGH RFID	RAJASTHAN ELECTRONICS & INSTRUMENTS LTD., 2,KANKPURA INDUSTRIAL AREA, JAIPUR-302012	20	53
17	DEVELOPMENT OF OPTICAL TIME DOMAIN REBLECTOMETER(OTDR)	AISWARYA TELECOM, PVT. LTD. 3C, PAMRAT COMMERCIAL COMPLEX OPP:AG OFFICE SIFLERD, HYDERABAD-4	35	87
18	DEVELOPMENT OF A LEARNING CONTENT MANAGEMENT SYSTEM(LCMS) WITH AN INTELLIGENT AUTHORITY TOOL	APTECH LIMITED, IT 1&2,SDF VII, SEEPZ, ANDHERI(E), MUMBAI-400093 AND IIIT,ALLAHABAD	60	260
19	DEVELOPMENT OF CTI(COMPUTER TELEPHONY INTEGRATION) BASED CALL CENTRE SOFTWARE	SM TELESYS LTD(SMTL), A-51,SECTOR-8,NOIDA(UP)-201 301 AND SRI ATAL BIHARI VAJPAYEE INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT(IIITM)	30	85
20	DEV. OF MEMBRANE TECHNOLOGY FOR NATURAL GAS SEPARATION	ENGINEERS INDIA LTD., ENGINEERS INDIA BHAVAN; 1, BHIKAJI CAMA PLACE; NEW DELHI - 110 066 AND O N G C, HAZIRA & I I C T HYDERABAD	42	148
21	CAST DESIGN SYSTEM FOR AIDING IN THE INTELLIGENT COMPUER AIDED DESIGN OF CASTINGS	ORIENT SOFTWARE PVT. LTD.,, BANGALORE AND INDIAN INSTITUTE OF SCIENCE, SCIENCE P. O., BANGALORE - 560 012	25	54
22	DEVELOPMENT AD DEMONSTRATION OF 'POLYMERIC FATLIQORS' FOR UPHOLSTERY LEATHER UNDER TECHNOLOGY DEVELOPMENT & INNOVATION PROGRAMME	HARYANA LEATHER CHEMICALS LIMITED, 1004, BHIKAJI CAMA BHAWAN, BHIKAJI CAMA PLACE, NEW DELHI-110 066	75	228
23	ESTABLISHING BIO CNOTROL AGENT PRODUCTION UNIT	T.STANES AND COMPNANY LIMITED, 8/23-24,RACE COURSE ROAD, COIMBATORE-641018	180	375

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
24	CONTROL OF PSYCHROPHILIC AND PSYCHROTROPHIC FOOD SPOILAGE MICROORGANISMS IN COLD STORAGES- AN ECOFRIENDLY APPROACH	M/S SCHEVARAN LABORATORIES PVT. LTD, MYSORE, 427/B,HEBBAL INDUSTRIAL AREA, METAGALLY POST, MYSORE-571186 AND C F T R I , MYSORE	8	23
25	DESIGN, DEVELOPMET, AND DEMONSTRATION OF INNOVATIVE EQUIPMENT FOR IMPROVED ORGANIC MANURE PROCESS FROM MUNICIPAL SOLID WATE AT A PILOT SCALE	BULL MACHINE(PVT) LIMITED, S.F.NO. 5/1-A, TRICHY ROAD, L&T BYEPASS JN., CHINTHAMANI PUDUR POST, COIMBATORE-641103 AND NIL	85	196
26	DESIGN, DEV. AND MANUFACTURE OF (1) 5¾ DIGIT MULTIMETER, (2) 6¾ DIGIT MULTIMETER	RISHABH INSTRUMENTS (P) LTD., PLOT NO. F-31, M I D C SATPUR, NASHIK - 422 007	55	136
27	DEVELOPMENT OF FLAME RETARDANT LOW SMOKE MATERIAL FOR WIRES AND CABLESFOR SHORTING APPLICATIONS	FARCOM CABLE SYSTEMS (P) LTD., OVER TANNARY ROAD,BANGALORE-560045,[NO. 26, 6TH CROSS, P.B. NO. 171, VASANTHNAGAR, BANGALORE -560 052, KARNATAKA AND CENTRAL POWER RESEARCH INSTITUTE, NEW B E L ROAD, P. B. NO. 9401, BANGALORE - 560 094, KARNATAKA	38	105
28	INTEGRATED PILOT DEMONSTRATION PLANT FOR FRUIT PROCESSING	MANAGEMENT OF TRIBAL AREA FOUNDATION, MATA FOUNDATION,IMPHAL, NEW DELHI AND C F T R I, MYSORE, MYSORE	100	320
29	DEVELOPMENT AND TESTING OF MINI DRY H CL GAS COTTON SEED DELINTING PLANT.	MAHARASHTRA STATE SEEDS CORPORATION LTD., AKOLA-444 001 AND I I T, POWAI, BOMBAY	31	93
30	DESIGN AND MANUFACTURE OF PROTOTYPE CERAMIC MEMBRANE FILTRATION UNIT FOR PRODUCTION OF SAFE DOMESTIC DRINKING WATER	BHARAT HEAVY ELECTRICALS LTD.,, CERAMIC BUSINESS UNIT, P. B. NO. 1245, I I SC. POST, BANGALORE - 560 012 AND CERAMIC TECHNOLOGICAL INSTT. & N C L, P. B. NO. 1245, BANGALORE - 560 012 & DR. HOMI BHABHA RD., PUNE - 411 018	70	149
31	DEVELOPMENT TO COMPLETE THE R A D A R LEVEL GAUGING SYSTEMS	S. B. ELECTRO - MECHANICALS (P) LTD., PUNE	16	35
32	TECHNOLOGY DEMONSTRATION PROJECT FOR TEST ROADSTRETCH USING MARBLE SLURRY DUST IN KOTELA VILLAGE OF RAJSAMAND DISTRICT UNDER DISTRICT POVERTY INITIATIVE PROJECT(DPIP)	UDAIPUR CHAMBER OF COMMERECE AND INDUSTRY(UCCI),UDAIPUR AND CENTRAL ROAD RESEARCH INSTITUTE(CRRI)	9	20

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
33	CONCEPTUAL STUDIES ON LIGHTER-THAN-AIR VEHICLE (LTAV) SYSTEM FOR TOURISM AS WELL AS AIR FRRY ACROSS RIVER BANKS IN NER	NATIONAL AEROSPACE LABORATORIESL, BANGALORE AND IIT B, BOMBAY	10	10
34	DEVELOPMENT OF A S I C BASED ENERGY METER	BHARAT HEAVY ELECTRICALS LTD.,, ELECTRONICS DIVISION, MYSORE ROAD, BANGALORE 560 026, KARNATAKA AND SEMICONDUCTOR COMPLEX LTD., CHANDIGARH	23	46
35	"PROCESS DEVELOPMENT FOR THE MANUFACTURE OF 3-AMINO-3AZABICYCLO [3.3.0] OCTANE"	BAL PHARMA LTD., BANGALORE, BAL PHARMA LTD., 21&22, BOMMASANDRA INDUSTRIAL AREA, BANGALORE - 560 099 AND NIL, NIL	50	150
36	IDENTIFICATION DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM FOREST PLANTS/WEEDS AND AGRICULTURAL WASTE	SIKKIM KHADI & VILLAGE INDUSTRIES BOARD, SIKKIM AND FOREST REASEARCH INSTITUTE(FRI), DEHRADUN	58	134
37	DEVELOPMENT OF INACTIVATED VACCINE USING NATIVE ISOLATES OF MYCOBACTERIUM AVIUM SUBSP. PARATUBERCULOSIS AGAINST JOHNE'S DISEASE IN GOATS AND SHEEP	CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA, 1ST FLOOR, GOPI COMPLEX, DHOLI PYAU, MATHURA(U.P.)-281001 AND CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA-281122	8	16
38	DEVELOPMNT OF ACTIVE PHARMACEUTICAL INGREDIENTS(API),API INTERMEDIATES,METAL ACETYLACETONATES	M/S SMS PHARMACEUTICALS LIMITED, INDUSTRIAL ESTATE, KAZIPALLI VILLAGE, JINNARAM MANDAL, MEDAK DT. PIN-502319 AND INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY(IICT)	135	475
39	DEVELOPMENT OF PROCESS FOR MANUFACTURING OF 1 BROMO 3-CHLORO PROPANE(B.C.P) & 1,3 DIBROMO PROPANE(D.B.P) IN PILOT PLANT	ANU'S LABORATORIES LTD., A49, MADHURANAGAR, VENGALRAONAGAR, HYDERABAD,A.P.-500038 AND KOBE ENTERPRISES, GEETA APPARTMENTS, SANTOSHNAGAR, MEHDIPATNAM, HYDERABAD	64	130
40	DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM THE FOREST PLANTS OF UTTRANCHAL	FOREST RESEARCH INSTITUTE, PO.-NEW FOREST, DEHRADUN-248006	50	61
41	DEVELOPMENT OF PROCESS FOR THE MANUFACTURE OF ETHYL 2(2-AMINOTHIAZOL-4-YL)-2- METHOXYIMINOACETATE AND 2-FORMYLAMINO-4-THIAZOLE ACETIC ACID ETHYL ESTER IN PILOT PLANT	PUNJAB CHEMICALS & PHARMACEUTICALS LTD., 107,ANSAL BHAWAN, KG ROAD, NEW DELHI-110 001 AND M/S PROCESS DESIGN & ENGINEERING COMPANY CONSULTANTS, CHANDIGARH	65	141

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
42	DEVELOPMENT OF POLYMORPHIC FORMI CLOPIDOGREL BISULPHAE	M/S ARCH PHARMALABS LTD, 'H' WING, 4TH FLOOR, TAX CENTRE, OFF SAKI VIHAR ROAD,CHANDIVALI, ANDHERI(E), MUMBAI-400072 AND ,	40	105
43	DEVELOPING A COMMERICAL PRODUCT FOR THALASSEMIA - THE BASIC TECHNOLOGY	FDC LIMITED, 142-48, S.V> ROAD,	40	80
44	DEVELOPMENT OF AN IMPROVED TILTING DISC HEART VALVE PROSTHESIS	T T K HEALTHCARE LIMITED, 6,CATHEDRAL ROAD,CHENNAI-600086 AND SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY, BIOMEDICAL TECHNOLOGY WING, SATEMOND PALACE, POOJAPPURA,THRIUVANANTHAPURAM-695012	40	90
45	DEVELOPMENT OF DIGITAL AXLE COUNTER	CENTRAL ELECTRONICS LTD., SAHIBABAD, 4, INDUSTRIAL AREA,SAUR URJA MARG, SAHIBABAD-201010, UP	70	146
46	DEV. OF ENERGY EFFICIENT FAN SYSTEM	PARAG FANS AND COOLING SYSTEMS LTD.,	28	72
47	DEVELOPMENT AND DEMONSTRATION OF TECHNOLOGY OF CONTINUOUS HYDROGENATION OF FATTY ACIDS AND OLEO CHEMICAL PLANTS	MECPRO HEAVY ENGINEERING LIMITED, 610,SOM DATT CHAMBER-II, BHIKAJI CAMA PLACE , NEW DELHI-110066	70	145
48	DEVELOPMENT OF TECHNOLOGY AND VALIDATION OF DESIGN METHODOLOGY OF MANUFACTURE OF ENERGY EFFICIENT PUMPS	PROCESS PUMPS(I) PVT. LTD., PLOT NO.86,III PHASE, PEENYA INDUSTRIAL AREA,BANGALORE-560 058 AND DEPT. OF MECHNICAL EBGG, IISC, BANGALORE-560 012	14	48
49	DEV. OF TECH. AND EQUIPMENT FOR PRODUCTION OF LARGE DIAMETER STONEWARE/ VITRIFIED CLAY PIPES	PRIYA KLAY (P) LTD., NEW DELHI	60	148

Annexure 9

LIST OF TDDP RUNNING PROJECTS

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
1	DEVELOPMENT OF HIGH SENSITIVITY PHOTO CATHODE FOR 18 MM SUPER GEN IMAGE INTENSIFIER TUBES	BEL OPTRONIC DEVICES LTD.(EARLIER -BE-DELFT ELECTRONICS LTD., PUNE, EL-30, JBLOCK, BHOSARI INDUSTRIAL AREA, PUNE-411026	71	353
2	DEVELOPMENT OF FRAUD MANAGEMENT AND CONTROL CENTRE(FMCC)	MIC ELECTRONICS LIMITED, A-4, ELECTRONIC COMPLEX, KUSHAIGUDA, HYDERABAD-500 062	33	77
3	DEVELOPMENT OF STM-1 BASED CUSTOMER PREMISES EQUIPMENT	CORAL TELECOM AND NETAJI SUBHAS INSTITUTE OF TECHNOLOGY	80	227
4	DEV. OF FULLY AUTOMATED HIGH SPEED BLOOD CHEMISTRY ANALYSER, MODEL X L-100	TRANSASIA BIOMEDICALS LTD., MUMBAI	90	226
5	DEVELOPENT OF TUNABLE TELEMETRY RECEIVER	PARK CONTROLS AND COMMUNICATION LTD., 22,80 FEET ROAD HAL 3RD STAGE, BANGALORE-560075	125	365
6	DEVELOPMENT OF SPECIAL VERSION OF LOW LOSS RF, DATA BUS ELECTRONIC WIRES AND CABLES, LASER MARKED LOOM ASSEMBLIES AND CABLE HARDNESSES FOR EW SYSTEMS, MARINE APPLICATIONS AND AEROSAPCE APPLICATIONS	RADIANT CABLES PVT. LTD., B-1, INDUSTRIAL ESTATE, SANATHNAGAR,HYDERABAD-500018	62	137
7	DEVELOPMENT OF HIGHER DIMENSIONAL CORD WIRE A HIGH STUD WIRE FEEDER	ARDEE BUSINESS SERVICE PVT. LTD., BB-8, CVIL TENT SHOP ROORKELA-769004	70	184
8	DEVELOPMENT OF PIEZOELECTRICALLY ACTUATED MICRO MECHENICAL SWITCH OF RF APPLICATIONS	BHARAT ELECTRONICS LTD., BANGALORE	20	50
9	DEVELOPMENT OF KNEE JOINT, HIP JOINT, SHOULDER JOINT & ELBOW JOINT	POONA HEALTH SERVICES PVT. LTD, SANCHHETI	120	290
10	DEVELOPMENT OF UPGRADED DIGITAL VOICE LOGGER WITH 32 CHANNELS,E1 AND FAX COMPATIBILITY	ABACUS SOFTECH LTD., A-85(2ND FLOOR, EAST OF KAILASH, NEW DELHI-110065	75	215
11	DEVELOPMENT AND DEMONSTRATION OF HIGH ENERGY DENSITY VALVE-REGULATED LEAD-ACID BATTERIES FOR ELECTRIC VEHICLES	NED ENERGY LIMITED, 6-3-1109/1,NAVBHARAT CHAMBERS, RAJ BHAVAN ROAD HYDERABAD-500082 AND INDIAN INSTITUTE OF SCIENCE, BANGALORE	46	121

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
12	DESIGNING AND DEVELOPING THE TECHNOLOGY FOR MANUFACTURING OF EHV COMPOSITE INSULATOR FOR APPLICATION IN 132KV,22KV & 400KV ELECTRIC POWER T&D LINE.	GOLDSTONE TELESEVICES LIMITED, AMARCHAND SHARMA COMPLEX, S.D.ROAD,SECUNDERABAD-500 003	200	404
13	DEVELOPMENT OF DIGITAL RADIO RELAY SYSTEM	HBL NIFE POWER SYSTEM LIMITED, 8-2-601,ROAD NO.10, BANJARA HILLS, HYDERABAD-500034	154	458
14	DEV OF 6 DOF ELECTRICAL MOTION PLATOFRM	ZEN TECHNOLOGIES LIMITED, B-42, INDUSTRAIL ESTATE, SANATH NAGAR, HYDERABAD 500018 AND ,	200	467
15	DEVELOPMENT OF UNIQUE DEROVO DRUG DESIGN TOOL	CELESTRICAL LABS LTD, PLOTS 235A, ROAD NO36,JUBLEE HALL,HYDERABAD-500033	75	291
16	ANIMAL IDENTIFICATION SYSTEM THROUGH RFID	RAJASTHAN ELECTRONICS & INSTRUMENTS LTD., 2,KANKPURA INDUSTRIAL AREA, JAIPUR-302012	20	53
17	DEVELOPMENT OF OPTICAL TIME DOMAIN REBLECTOMETER(OTDR)	AISWARYA TELECOM, PVT. LTD. 3C, PAMRAT COMMERCIAL COMPLEX OPP:AG OFFICE SIFLERD, HYDERABAD-4	35	87
18	DEVELOPMENT OF A LEARNING CONTENT MANAGEMENT SYSTEM(LCMS) WITH AN INTELLIGENT AUTHORITY TOOL	APTECH LIMITED, IT 1&2,SDF VII, SEEPZ, ANDHERI(E), MUMBAI-400093 AND IIIT,ALLAHABAD	60	260
19	DEVELOPMENT OF CTI(COMPUTER TELEPHONY INTEGRATION) BASED CALL CENTRE SOFTWARE	SM TELESYS LTD(SMTL), A-51,SECTOR-8,NOIDA(UP)-201 301 AND SRI ATAL BIHARI VAJPAYEE INDIAN INSTITUTE OF INFORMATION TECHNOLOGY AND MANAGEMENT(IIITM)	30	85
20	DEV. OF MEMBRANE TECHNOLOGY FOR NATURAL GAS SEPARATION	ENGINEERS INDIA LTD., ENGINEERS INDIA BHAVAN; 1, BHIKAJI CAMA PLACE; NEW DELHI - 110 066 AND O N G C, HAZIRA & I I C T HYDERABAD	42	148
21	CAST DESIGN SYSTEM FOR AIDING IN THE INTELLIGENT COMPUER AIDED DESIGN OF CASTINGS	ORIENT SOFTWARE PVT. LTD.,, BANGALORE AND INDIAN INSTITUTE OF SCIENCE, SCIENCE P. O., BANGALORE - 560 012	25	54
22	DEVELOPMENT AD DEMONSTRATION OF 'POLYMERIC FATLIQORS' FOR UPHOLSTERY LEATHER UNDER TECHNOLOGY DEVELOPMENT & INNOVATION PROGRAMME	HARYANA LEATHER CHEMICALS LIMITED, 1004, BHIKAJI CAMA BHAWAN, BHIKAJI CAMA PLACE, NEW DELHI-110 066	75	228
23	ESTABLISHING BIO CNOTROL AGENT PRODUCTION UNIT	T.STANES AND COMPNANY LIMITED, 8/23-24,RACE COURSE ROAD, COIMBATORE-641018	180	375

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
24	CONTROL OF PSYCHROPHILIC AND PSYCHROTROPHIC FOOD SPOILAGE MICROORGANISMS IN COLD STORAGES- AN ECOFRIENDLY APPROACH	M/S SCHEVARAN LABORATORIES PVT. LTD, MYSORE, 427/B,HEBBAL INDUSTRIAL AREA, METAGALLY POST, MYSORE-571186 AND C F T R I , MYSORE	8	23
25	DESIGN, DEVELOPMET, AND DEMONSTRATION OF INNOVATIVE EQUIPMENT FOR IMPROVED ORGANIC MANURE PROCESS FROM MUNICIPAL SOLID WATE AT A PILOT SCALE	BULL MACHINE(PVT) LIMITED, S.F.NO. 5/1-A, TRICHY ROAD, L&T BYEPASS JN., CHINTHAMANI PUDUR POST, COIMBATORE-641103 AND NIL	85	196
26	DESIGN, DEV. AND MANUFACTURE OF (1) 5¾ DIGIT MULTIMETER, (2) 6¾ DIGIT MULTIMETER	RISHABH INSTRUMENTS (P) LTD., PLOT NO. F-31, M I D C SATPUR, NASHIK - 422 007	55	136
27	DEVELOPMENT OF FLAME RETARDANT LOW SMOKE MATERIAL FOR WIRES AND CABLESFOR SHORTING APPLICATIONS	FARCOM CABLE SYSTEMS (P) LTD., OVER TANNARY ROAD,BANGALORE-560045,[NO. 26, 6TH CROSS, P.B. NO. 171, VASANTHNAGAR, BANGALORE -560 052, KARNATAKA AND CENTRAL POWER RESEARCH INSTITUTE, NEW B E L ROAD, P. B. NO. 9401, BANGALORE - 560 094, KARNATAKA	38	105
28	INTEGRATED PILOT DEMONSTRATION PLANT FOR FRUIT PROCESSING	MANAGEMENT OF TRIBAL AREA FOUNDATION, MATA FOUNDATION,IMPHAL, NEW DELHI AND C F T R I, MYSORE, MYSORE	100	320
29	DEVELOPMENT AND TESTING OF MINI DRY H CL GAS COTTON SEED DELINTING PLANT.	MAHARASHTRA STATE SEEDS CORPORATION LTD., AKOLA-444 001 AND I I T, POWAI, BOMBAY	31	93
30	DESIGN AND MANUFACTURE OF PROTOTYPE CERAMIC MEMBRANE FILTRATION UNIT FOR PRODUCTION OF SAFE DOMESTIC DRINKING WATER	BHARAT HEAVY ELECTRICALS LTD.,, CERAMIC BUSINESS UNIT, P. B. NO. 1245, I I SC. POST, BANGALORE - 560 012 AND CERAMIC TECHNOLOGICAL INSTT. & N C L, P. B. NO. 1245, BANGALORE - 560 012 & DR. HOMI BHABHA RD., PUNE - 411 018	70	149
31	DEVELOPMENT TO COMPLETE THE R A D A R LEVEL GAUGING SYSTEMS	S. B. ELECTRO - MECHANICALS (P) LTD., PUNE	16	35
32	TECHNOLOGY DEMONSTRATION PROJECT FOR TEST ROADSTRETCH USING MARBLE SLURRY DUST IN KOTELA VILLAGE OF RAJSAMAND DISTRICT UNDER DISTRICT POVERTY INITIATIVE PROJECT(DPIP)	UDAIPUR CHAMBER OF COMMERECE AND INDUSTRY(UCCI),UDAIPUR AND CENTRAL ROAD RESEARCH INSTITUTE(CRRI)	9	20

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
33	CONCEPTUAL STUDIES ON LIGHTER-THAN-AIR VEHICLE (LTAV) SYSTEM FOR TOURISM AS WELL AS AIR FRRY ACROSS RIVER BANKS IN NER	NATIONAL AEROSPACE LABORATORIESL, BANGALORE AND IIT B, BOMBAY	10	10
34	DEVELOPMENT OF A S I C BASED ENERGY METER	BHARAT HEAVY ELECTRICALS LTD.,, ELECTRONICS DIVISION, MYSORE ROAD, BANGALORE 560 026, KARNATAKA AND SEMICONDUCTOR COMPLEX LTD., CHANDIGARH	23	46
35	"PROCESS DEVELOPMENT FOR THE MANUFACTURE OF 3-AMINO-3AZABICYCLO [3.3.0] OCTANE"	BAL PHARMA LTD., BANGALORE, BAL PHARMA LTD., 21&22, BOMMASANDRA INDUSTRIAL AREA, BANGALORE - 560 099 AND NIL, NIL	50	150
36	IDENTIFICATION DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM FOREST PLANTS/WEEDS AND AGRICULTURAL WASTE	SIKKIM KHADI & VILLAGE INDUSTRIES BOARD, SIKKIM AND FOREST REASEARCH INSTITUTE(FRI), DEHRADUN	58	134
37	DEVELOPMENT OF INACTIVATED VACCINE USING NATIVE ISOLATES OF MYCOBACTERIUM AVIUM SUBSP. PARATUBERCULOSIS AGAINST JOHNE'S DISEASE IN GOATS AND SHEEP	CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA, 1ST FLOOR, GOPI COMPLEX, DHOLI PYAU, MATHURA(U.P.)-281001 AND CENTRAL INSTITUTE FOR RESEARCH ON GOATS, MAKHDOOM , PO FARAH, MATGURA-281122	8	16
38	DEVELOPMNT OF ACTIVE PHARMACEUTICAL INGREDIENTS(API),API INTERMEDIATES,METAL ACETYLACETONATES	M/S SMS PHARMACEUTICALS LIMITED, INDUSTRIAL ESTATE, KAZIPALLI VILLAGE, JINNARAM MANDAL, MEDAK DT. PIN-502319 AND INDIAN INSTITUTE OF CHEMICAL TECHNOLOGY(IICT)	135	475
39	DEVELOPMENT OF PROCESS FOR MANUFACTURING OF 1 BROMO 3-CHLORO PROPANE(B.C.P) & 1,3 DIBROMO PROPANE(D.B.P) IN PILOT PLANT	ANU'S LABORATORIES LTD., A49, MADHURANAGAR, VENGALRAONAGAR, HYDERABAD,A.P.-500038 AND KOBE ENTERPRISES, GEETA APPARTMENTS, SANTOSHNAGAR, MEHDIPATNAM, HYDERABAD	64	130
40	DEVELOPMENT AND UTILISATION OF NATURAL DYES FROM THE FOREST PLANTS OF UTTRANCHAL	FOREST RESEARCH INSTITUTE, PO.-NEW FOREST, DEHRADUN-248006	50	61
41	DEVELOPMENT OF PROCESS FOR THE MANUFACTURE OF ETHYL 2(2-AMINOTHIAZOL-4-YL)-2- METHOXYIMINOACETATE AND 2-FORMYLAMINO-4-THIAZOLE ACETIC ACID ETHYL ESTER IN PILOT PLANT	PUNJAB CHEMICALS & PHARMACEUTICALS LTD., 107,ANSAL BHAWAN, KG ROAD, NEW DELHI-110 001 AND M/S PROCESS DESIGN & ENGINEERING COMPANY CONSULTANTS, CHANDIGARH	65	141

(Continued)

SL NO.	PROJECT	NAME	DSIR SHARE	TOTAL COST
42	DEVELOPMENT OF POLYMORPHIC FORMI CLOPIDOGREL BISULPHAE	M/S ARCH PHARMALABS LTD, 'H' WING, 4TH FLOOR, TAX CENTRE, OFF SAKI VIHAR ROAD,CHANDIVALI, ANDHERI(E), MUMBAI-400072 AND ,	40	105
43	DEVELOPING A COMMERICAL PRODUCT FOR THALASSEMIA - THE BASIC TECHNOLOGY	FDC LIMITED, 142-48, S.V> ROAD,	40	80
44	DEVELOPMENT OF AN IMPROVED TILTING DISC HEART VALVE PROSTHESIS	T T K HEALTHCARE LIMITED, 6,CATHEDRAL ROAD,CHENNAI-600086 AND SREE CHITRA TIRUNAL INSTITUTE FOR MEDICAL SCIENCES & TECHNOLOGY, BIOMEDICAL TECHNOLOGY WING, SATEMOND PALACE, POOJAPPURA,THRIUVANANTHAPURAM-695012	40	90
45	DEVELOPMENT OF DIGITAL AXLE COUNTER	CENTRAL ELECTRONICS LTD., SAHIBABAD, 4, INDUSTRIAL AREA,SAUR URJA MARG, SAHIBABAD-201010, UP	70	146
46	DEV. OF ENERGY EFFICIENT FAN SYSTEM	PARAG FANS AND COOLING SYSTEMS LTD.,	28	72
47	DEVELOPMENT AND DEMONSTRATION OF TECHNOLOGY OF CONTINUOUS HYDROGENATION OF FATTY ACIDS AND OLEO CHEMICAL PLANTS	MECPRO HEAVY ENGINEERING LIMITED, 610,SOM DATT CHAMBER-II, BHIKAJI CAMA PLACE , NEW DELHI-110066	70	145
48	DEVELOPMENT OF TECHNOLOGY AND VALIDATION OF DESIGN METHODOLOGY OF MANUFACTURE OF ENERGY EFFICIENT PUMPS	PROCESS PUMPS(I) PVT. LTD., PLOT NO.86,III PHASE, PEENYA INDUSTRIAL AREA,BANGALORE-560 058 AND DEPT. OF MECHNICAL EBGG, IISC, BANGALORE-560 012	14	48
49	DEV. OF TECH. AND EQUIPMENT FOR PRODUCTION OF LARGE DIAMETER STONEWARE/ VITRIFIED CLAY PIPES	PRIYA KLAY (P) LTD., NEW DELHI	60	148

II-A. INDUSTRIAL R&D PROMOTION PROGRAMME

1. OBJECTIVES

The broad objectives of the Industrial Research & Development Promotion Programme are to:

- Bring in-house R&D into sharper focus;
- Strengthen R&D infrastructure in industry and Scientific and Industrial Research Organisations (SIROs);
- Promote R&D initiatives of the industry and SIROs;
- Ensure that the contributions made by the in-house R&D centres and SIROs dovetail adequately in the overall context of technological and industrial development.

2. AREAS OF COVERAGE

The specific areas covered under the component scheme are:

- In-house R&D in Industry
- Scientific and Industrial Research Organisations (SIROs)
- Fiscal Incentives for Scientific Research

Activities and achievements in each of above areas are presented below:

3. IN-HOUSE R&D IN INDUSTRY

3.1 Recognition of In-house R&D Units

A strong S&T infrastructure has been created in the country. This covers a chain of national laboratories, specialised R&D centres, various academic institutions and training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures have been introduced from time to time, to meet the changing industrial and technological requirements of the industry. The Government has been giving special attention to promotion and support to industrial research in industry. Several tax incentives have also been provided which encourage and make it financially attractive for industrial units to establish their own in-house R&D units.

A scheme for granting recognition to in-house R&D units in industry is operated by the DSIR. A number of incentives and support measures are made available to in-house R&D units.

The in-house R&D units qualifying for recognition are expected to be engaged in research and development activities related to the line of business of the firm, such as, development of new technologies, design and engineering, process / product / design improvements, developing new methods of analysis and testing; research for increased efficiency in use of resources, such as, capital equipment, materials and energy; pollution control, effluent treatment and recycling of waste products.

The R&D activities are expected to be separate from routine activities of the firm, such as, production and quality control. The in-house R&D units should have staff exclusively engaged in R&D and headed by a full-time R&D manager who would have direct access to the chief executive or to the board of directors depending upon the size of the unit. The in-house R&D units are also expected to maintain separate identifiable infrastructure and R&D accounts.

Number of in-house R&D units recognised by DSIR increased steadily from about 100 in 1973 to about 275 by 1975, to over 700 by 1980, around 925 by 1985, over 1100 in 1990 over 1200 in 1995 and thereafter is hovering between 1200 to 1250; and was 1253 in December 2007. Of these, nearly 1180 are in

the private sector and the remaining units are in public/joint sector. A revised and updated 'Directory of Recognised in-house R&D Units' was brought out during November 2007. This Directory lists 1247 recognised in-house R&D units, giving registration number, name and mailing address of the company, location of the in-house R&D unit(s) and validity of DSIR recognition. The data on these R&D units has been computerised and updated.

For the purpose of recognition, the R&D units have to apply to DSIR as per a prescribed proforma. The proforma and other details about the scheme are provided to the interested companies on request. The proforma and details of the scheme are also available at DSIR website (http://www.dsir.gov.in). The applications received are scrutinised for their completeness in the DSIR and are then circulated for comments to various other departments/agencies such as concerned administrative ministries, MSME, CSIR, ICAR, ICMR, ICAS, DBT, DCPC, DoT, DRDO, DIT and NRDC. The units seeking recognition are visited, if need be, by expert teams comprising of representatives of DSIR, as well as outside agencies, like, administrative ministries, CSIR, NRDC, DBT, ICAR, ICMR, DRDO, DIT, DoT, IITs and local educational and Research Institutions before they are taken up for consideration. In order to obtain first hand information on R&D activities of the applicant firms, discussions with the chiefs of the R&D unit and executives of the firm are also held in DSIR in many cases. During the discussions outside experts are invited and their comments are sought. The applications along with comments from outside agencies, visit reports, and the Department's own evaluation are considered by an Inter-Departmental Screening Committee constituted by the Secretary, DSIR. The Committee meets every month to consider the applications and makes recommendations to the Secretary, DSIR based on its evaluation of R&D infrastructure and R&D activities of the applicant firms.

During the year 2007, the Screening Committee met 12 times and considered 138 applications for recognition; 92 R&D units were granted fresh recognition and 31 applications were rejected. Approval of balance R&D units is under process.

The pendency at the end of December 2007 was 60, including 15 applications received during the month of December, 2007. A statement giving month-wise receipt, disposal and pendency of applications for recognition of in-house R&D units is given at **Annexure 1**.

During the year 2007, over 300 discussions/meetings were held with heads of in-house R&D units. Also, expert teams visited a number of in-house R&D units.

3.2 Renewal of Recognition

Recognition to R&D units is granted for a period ranging from 1 to 3 years. The R&D units are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of the recognition). Applications received for renewal of recognition are circulated to CSIR, NRDC and/or the concerned administrative department of Government of India for comments. The applications are examined in DSIR taking into account the inputs received from other agencies for taking suitable decision on their renewal. During the year 2007**,** 480 in-house R&D units were due for renewal of recognition beyond 31 March 2007; of which 425 applications were received. Based on the evaluation of the performance of the R&D units, renewal of recognition was granted to 420 R&D units.

Recognition granted to 5 companies could not be renewed because their R&D performance was not up to the mark. A statement showing month-wise receipt, disposal and pendency of the cases of renewal of recognition of the R&D units is given at **Annexure 2**.

3.3 Zonal Distribution of In-house R&D Units

The in-house R&D units are distributed throughout the country. There are around 185 units in the Northern Zone (Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir), around 110 units in Western Zone (Rajasthan and Gujarat), around 475 units in the Central Zone (Maharashtra, Madhya Pradesh and Orissa), around 392 units in the Southern Zone (Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and around 85 units in the Eastern Zone covering Bihar, West Bengal, Assam and other North-Eastern states and remaining in other places.

3.4 R&D Expenditure

The expenditure incurred by in-house R&D units in industry has steadily increased. During 1980-81 it was of the order of Rs.300 crores. In 1985-86, it was of the order of Rs.500 crores. It is estimated that the present R&D expenditure of the 1253 recognised R&D units is of the order of Rs.6800 crores. The share of public and joint sector is about 20% and that of private sectors about 80%. 147 In-house R&D units spend over Rs.5 crore each on R&D**,** 303 in-house R&D units spent between Rs.1 crore to Rs.5 crore each per annum on R&D. The lists of these R&D units are given in **Annexure 3 and 4** respectively.

3.5 R&D Infrastructure

The in-house R&D centres have created impressive infrastructural facilities for R&D including sophisticated testing facilities, laboratory equipment and pilot plant facilities. Analytical facilities such as HPLCs, IR spectrophotometers, UV-Vis spectrophotometers, NMR spectrometers, electron microscopes, particle size analyzers, portable particle counting systems; vibration test equipment, calorimeter and wind tunnel for complete evaluation of automobile air-conditioning system, ultra filtration equipment, sonicator, spectro fluorimeter, protein purification set up, digital viscometer, high temperature test and evaluation facilities, CAD-CAM facilities, rapid prototype building machines, greenhouse and tissue culture laboratory facilities are available with many in-house R&D units.

3.6 R&D Manpower

There has been a steady increase in R&D manpower employed by the in-house R&D units. By 1975-76, about 12,000 R&D personnel were employed by recognised in-house units, and by 1981-82, the figure was over 30,000. The present estimated manpower for the 1253 in-house R&D units is around 65,000, out of which around 20,000 R&D personnel are employed in public sector in-house R&D units and around 45,000 R&D personnel are employed in the private sector in- house R&D units. Of the total 65,000 R&D personnel, around 3500 are Ph.D's, 21,000 Post Graduates, 21,000 graduates and the rest are technicians and support staff.

3.7 Sectorwise Break-Up of In-house R&D Units

A broad sector-wise break-up of the recognised in-house R&D units is as below:

Chemical and Allied industries	521
Electrical & Electronics industries	275
Mechanical Engineering industries	184
Processing industries (Metallurgical, Refractories, Paper, Cement, Ceramics, Leather and others)	151
Agro and food processing industries and others	122

3.8 Achievements of In-house R&D Units

Some of the R&D achievements reported by the recognised in-house R&D units are listed below:

Chemical and Allied Industries

- Development and commercialization of processes for manufacture of P-Ethoxy ethyl Benzoate; P-Iso propoxy ethyl benzoate; 4-Methoxy benzoic acid; 2-Ethoxy benzoic acid; PHBA solvent process; Ethyl benzoate; Ethyl paraben sodium; Benzyl paraben; Ortho anisic acid; Methyl-5-Chloro-Ortho methoxy benzoate; Gujsol-01 (mixture of parabens); 4-Methyl salicylic acid and Iso propyl myristate.

- Development and commercialization of the anti oxidants:

  a) Tris (2,4-di-tert. butylphenyl) phosphate (kinox-68)
  b) 1,3,5-Tris(3,5-di-tert.butyl-4-hydroxybenzyl)-1,3,5-Triazine-2,4,6 (1H, 3H, 5H)-trione (kinox-34),
  c) N'-Hexamethylene-bis(3-(3,5-di-teri. butyl-4hydroxyben-3ylphenyl) propionamide) (kinox-98)
  d)1,3,5-Trimethyl-2,4,6-tris(3,5-di-tert. butyl-4-ydroxybenzyl)benzene (kinox-30) and
  e) ntaerythrityl-tetrakis-[-3-(3,5-di tert-butyl -4 hydroxy phenyl) propionate (kinox-10 SnF) .

- Invented 5-Loxin, a novel anti-inflammatory & anti- arthritic product.

- Developed solid Catalyst – external donor system for polypropylene technology based on current generation supported titanium catalyst system which enables polymer production without removal of catalyst residues due to higher productivity; polymer with desired molecular weight distribution; polymer with controlled degree of stereo-regularity without requiring removal of undesirable polymeric fractions.

- Technology development for conversion of industrial waste to value added products:- Production of forskolin of drug grade; Production of policosanol; Technology development for manufacture of industrial diols: - 1,2 - Hexanediol; 1,2 - Octanediol and Technology development for manufacture of resveratrol by a facile synthetic route.

- Developed novel route of synthesis for commercial manufacture of Olanzapine - antipsychotic; Gabapentine- anti-convulsant; Isradipine – antihyper-tensive antiangial; Quinapril – antihypertensive; Meprobamate - anxiolytic and 2 – Carboxymethoxy -3 –thiophene-sulfonyl Chloride – pharma indicate. The product have been commercialized.

Computer Software

- Development of SHAKTI Artillery combat command & control system (ACCCS). SHAKTI is a subsystem for tactical command, control and communication intelligence system for Indian Defence forces. System is for automation of all operational procedures and data management of artillery with complete support for command and control levels of corps, division, regiment, battery and guns.

- Design, development & optimization of multimedia subsystem (wireless embedded software for mobile phones).The package has subsystem which have been developed; Stored multimedia player; DVD-H Applica-tions; Streaming media player; 2 Way real-time video telephony over a circuit switch

network; Voice over IP & video over IP; Image viewer; Image capture;Camcorder.

- Development of Remote multi-pass wire drawing simulator (RMWDS). Its main features are:- Numerical modeling of multi-pass wire drawing; Virtual wire drawing platform for various innovative ideas and analysis; An interface for use of the model by production personal; Platform for optimization of die schedule with respect to power consumption & quality of wire; Mass deployment of model using remote connection for multi-location production sites; Platform to analyse the effect of the different parameters on wire drawing process.

Drugs & Pharmaceuticals Industries

- Development of two new molecules antidiabetic (DPP IV inhibitor); anti-inflammatory (PDE4 inhibitor).

- Development of New Drug Delivery systems based on liposomes. Two products namely Fungisome gel (liposomal Amphotericin B Gel) and Psorisome Gel(Liposomal Dithranol Gel). Both these products are based on application of liposomal technology for controlled delivery of drugs encapsulated in the liposomes.

- Development of a scientific method for identifying optimum packaging for pharmaceutical formulations; effective counterfeiting solution to the pharmaceutical solid dosages through innovative packaging material.

- Development of five new drug processes which drastically reduced the price of the five anti cancer drugs. Gefitinib an anti cancer drug used mainly in non small cell lung cancer; Bortezomib a new drug for multiple myeloma – a newpolymorph of the drug developed; Amifostine is a radio protective drug given after the radiation therapy; Zoledronic acid is mainly used in bone cancer patients; Letrozole: is mainly used in the post menopausal breast cancer.

Electrical and Electronic Industries

- Development of technology for high-energy Permanent Magnet Machines (PMM) to meet the requirements of defence sector, space applications and power sector.

- Development of energy efficient electronically controlled new generation brushless DC motors (Voyager – railway carriage fan). Developed brushless DC railway carriage fans which are electronically controlled**.**

Electronics / Opto Electronics Industries

- Design, development and commercialization of Universal Temperature Controller, 4 Channel Sequential Timer with relay output , and 15 Channel Sequential Timer with Solid state output, HM-300-Hour Meter with RS232 Communication.

- Development of new technology using their in-house R&D for handling power distribution system of India. Development of cluster metering and associated technologies result in development of highly integrated end to end energy measurement /auditing/ management solutions to the utilities.

- Development of cutting –edge technologies for recordable optical media such as DVD-RW 4 X Digital Versatile Disc, Mini RW Disc (Cam-Recorder Application) and high –speed (8X) re-writable digital versatile disc (DVD+RW) (8X) Disc.

- Development of 8/16/32/40 Channel Dense Wavelength Division Multiplexing (DWDM) System: Dense Wave Division Multiplexing (DWDM) technology is the latest development in the Telecom Transport Systems in the Optical Domain.
- Development & commercialization of Curtain flame ignition system for ignition in sinter mix in sinter plants at Bokaro Steel Plant and Rourkela Steel Plant.

Infrastructure Development

- Geo-textile sand container mattresses (GSCM) lining for temporary river diversion channels. An innovative high performance cost & time efficient, environment friendly alternative method of lining diverted channels. Uses technically superior synthetic material. Successfully developed & implemented at Teesta Low Dam Hydroelectric Project Stage-IV site, Jalpaiguri, West Bengal.

Mechanical Engineering Industries

- Development of indigenous "Dual plate check valves".
- Development of innovative solutions to irritant judder and rattling phenomenon observed in multi-plate wet clutches in Motorcycles being manufactured in the country.
- Design and development of **"**Intelligent illuminated non contact handle bar switch for motor cycle" with novel features such as non contact mechanism, illumination in handle bar switch, self cancellation blinkers and body control unit for motorcycle. The newly designed control system include domain such as elector-magnetism, optics, and electronics and the system has been packaged in ergonomically styled switch consoles.
- Design, development& commercialization of "Integral receiver dryer condenser" (IRDC) also called "Subcool Condenser". The novel feature of the sub cool condenser is integration of receiver dryer and the condenser, thus to improve the performance of the A.C. system and at the same time to eliminate the need for separate packaging space in the engine cabin and associated cost of the pipe connectors mounting brackets and manufacturing operations in the car assembly line.
- Design, development and test of "dampolators" an innovative product which combines functions of both isolator and harmonic balancer providing benefits of both these parts in a single unit.

New Materials

- Development of three composites. The high temperature resistant laminates permaglass 22 CIN (PM1) can insulate continuously at a temperature of 500^0 C. Stable insulation can be attained in any heated area such as Dry Arc Electric Furnaces and Drying Ovens.
- Development of bake hardening (BH) steels with a higher initial yield strength and good formability properties. These steels have shown 40 to 50 % increased strength as compared to conventional grades such as low carbon EDD and extra low carbon Interstitial Free Steel. The increase in strength of this new steel led to decrease in the thickness (hence decrease in weight) with an improvement in dent resistance of the material.

Pollution Control & Environmental Protection

- Development and manufacture of Gas Monitoring devices for fumigation industry, Flammable gas detection devices for industrial & domestic segments,

Breath Alcohol Analyzer for Traffic police, railways, hospital and Gas Sensors.

Processing Industries

- Development of a process to reduce the hexavalent chromium to trace levels (less then 0.01 ppm) in concentrates by using an organic reductant known as Myrobalam in collaboration with Central Leather Research Institute, Chennai.

Agro and Food Processing Industries

- Development and promotion of technology & products for environment friendly management of tissue borers of sugarcane using indigenously synthesized sex pheromones and patented water trap. Developed bollworm resistant high yielding high quality Bt cotton hybrids utilizing modern tools of biotechnology combined with traditional breeding methods.

3.9 Imports Made by In-house R&D Units

The recognised in-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities. These include: NMR, GLC, IR Spectro Photometer, HPTLC, GC-FTIR system, FT-NMR spectrometer, inverted phase contrast fluorescence microscope, microsheen digital opacity reflectometer, colour image analysis system, laser based particle size analyzer, laser scanning microscope, dionex ion chromatography system, mass emissions analysis system, digital distortion analyser, dielectric loss analyser, X-ray fluorescence spectro-photometer system, portable particle counting system, ultra filteration equipment, probe sonicator, protein purification set up digital viscometer, stereo zoom microscope, Auto Titrator, UV-Vis dual beam spectro-photometer, trinocular phase contrast microscope, cryptometer, elisa system, mass emission analysis system, prototyping machine, electrophoresis unit, microprocessor double ended inertia dynamometer, logic analyser, fibre optics evaluation kit, intelligent universal programmer, reference standards for chemical raw material testing purpose, microwave accelerated acid digestion system, pump for ultra filtration system and auto hardness tester, fuel ratio analyser, ignition timing meter, paper permissibility meter.

3.10 Other Benefits Availed by the Recognised R&D Units

The Department provides assistance to recognised in-house R&D units in a number of ways, such as cases of industrial R&D units requiring allotment of special controlled materials for R&D, permission to export of specialised products reserved for small scale industries by medium scale industries for test marketing in other countries and disposal of imported R&D equipment/instruments and pilot plant produce are examined for making suitable recommendations to concerned agencies.

Few cases regarding locational clearance with respect to expansion of R&D have been dealt with. A number of applications regarding disposal of R&D equipment and also, pilot plant produce; and permission for allotment for controlled materials required for R&D were examined and the decisions of the Department conveyed.

3.11 Conference, Awards and Publications

21st National Conference on in-house R&D in Industry

DSIR organised the 21st National Conference on in-house R&D in Industry, in association with the Federation of Indian Chambers of

Commerce and Industry (FICCI) during 15-16, November 2007 in New Delhi. The theme of the Conference was "R&D Innovations: For Indian Growth Dynamics" The Conference had four technical sessions viz. "Creating Infrastructure for R&D Innovations"; **"**Innovative R&D: Some success stories"; "Innovative R&D: Inclusive Growth" and "Government Incentives for Innovative R&D ". Attended by over 500 delegates from industry, National laboratories, IITs and universities, Scientific and Industrial Research Organisations (SIROs), Consultancy organisations, Government Departments, the Conference was inaugurated by Dr. T. Ramasami, Secretary, DST and Dr S.K. Brahmachari, Secretary, DSIR who also presented the DSIR National Awards for Outstanding in-house R&D Achievements (2007) to nine industrial units. Dr. K.T. Chacko, Director, Indian Institute of Foreign Trade (IIFT) delivered the valedictory address on 16th November 2007.

National Awards for Outstanding In-house R&D Achievements

In order to provide recognition to the efforts of industry towards innovative research and technological development, the National Awards for R&D Efforts in Industry were instituted in 1987 by the DSIR. These awards are in the form of silver shields and are presented along with citations at the inaugural session of the annual National Conference on in-house R&D in Industry. So far, 171 companies have won the DSIR National R&D Awards for Outstanding in-house R&D achievements. The list of the award winners in the year 2007 is as follows:

- ***Chemical and Allied Industries***
  Laila Impex, Vijayawada (A.P)
- ***Agro & Food Processing Industries***
  Pest Control (India) Pvt. Ltd, Bangalore
- ***Pollution Control & Environmental Protection***
  United Phosphorous Ltd, Vapi (Gujarat)
- ***Mechanical Engineering Industries***
  Minda Industries Ltd, Gurgaon
- ***Electrical Industries***
  Crompton Greaves Ltd, Mumbai
- ***Electronics / Opto Electronics Industries***
  Ananth Technologies Ltd, Hyderabad
- ***Computer Software***
  Sasken Communication Technologies Ltd, Bangalore
- ***Technology Absorption of Imported Technologies***
  Reliance Industries Ltd, Surat
- ***Successful Commercialization of Technologies acquired from others***
  Tata Steel Ltd, Jamshedpur

3.12 Publications

Outstanding In-house R&D Achievements - 2007

The DSIR publication "Outstanding in-house R&D Achievements (2007)," covering the award winning achievements of 9 companies, was released during the inaugural session of the 21st National Conference on in-house R&D in Industry.

In-house R&D in Industry – An Information Update

As the number of in-house R&D Centres has increased while the activities of DSIR have also diversified significantly with respect to in-house R&D units, it was felt appropriate to devise a communication system between DSIR and in-house R&D units. Accordingly, the DSIR started bringing out a quarterly Information Update on in-house R&D in industry on a regular basis since April 1988. The Information Update intended to provide a fast communication link between DSIR,

in-house R&D units and SIROs and serve to disseminate useful and important information relevant to R&D in Industry. During 2007, three issues of in-house R&D in Industry were brought out in April, July, October 2007. These have been widely disseminated to industry, SIROs, Government Departments and others.

Research and Development in Industry : An Overview

A publication entitled "*Research and Development in Industry : An Overview"* was brought out on the occasion of the 21st National Conference on in-house R&D in Industry (November 2007). The publication gives details of resources devoted to scientific and technological activities, international comparison of S&T indicators, fiscal incentives and support measures available for research in India, promotional schemes for R&D operated by DSIR and other Government Departments.

4. SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

4.1 Recognition of Scientific and Industrial Research Organisations (SIROs)

The DSIR had launched a scheme of granting recognition to SIROs in 1988. SIROs recognised by DSIR are eligible for Customs Duty Exemption and Excise Duty Waiver in terms of notification Nos. 51/96-Customs dated 23.7.1996 and 10/97-Central Excise dated 1.3.1997 respectively.

The DSIR has brought out Guidelines for Recognition of SIROs, which give procedural details and application proformae for seeking recognition under the SIRO Scheme. Functional SIROs having broad based governing council, research advisory committee, research personnel, infrastructural facilities for research, well defined, time bound research programmes and clearly stated objectives of undertaking scientific research, are considered eligible for recognition by DSIR. The investments of surplus funds not needed for immediate research should be in accordance with the Income-tax Act, 1961.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an Inter- departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Sciences Research (ICSSR) and University Grants Commission (UGC). The recommendations of the Screening Committee are put up for approval of Secretary, DSIR. The recognition is effective from the date of approval of Secretary. Retrospective approval is not granted.

During the period January 2007 to December 2007, the Screening Committee met 8 times and recommended 27 cases for recognition as SIROs under 1988 Scheme of DSIR. These include cases in the natural and applied sciences, agricultural, medical sciences and social sciences. List of these SIROs is furnished at **Annexure 5.**

Recognition granted to SIROs is for duration ranging from 1 to 3 years. The SIROs are advised to apply for renewal of recognition well in advance (3 months prior to the date of expiry of recognition). Such applications received for renewal of recognition are examined by Research Review Groups by involving representatives from ICAR, ICMR, CSIR and ICSSR depending on the area. Based on the evaluation made by the Research Review Groups, renewal of recognition is granted to SIROs.

At present there are 570 SIROs duly recognised by DSIR; of these, 198 are in the

area of natural and applied sciences, 200 are in the area of medical sciences, 38 are in the area of agricultural sciences, 108 are in the area of social sciences and 26 are universities/colleges. Of these 570 SIROs, the renewal of recognition beyond 31.3.2007 of 31 SIROs is under consideration for want of further information/ clarification. DSIR has brought out a directory of recognised SIROs in November 2007.

The SIROs have employed qualified scientists and researchers and have also established good infrastructural facilities for research. They have developed new processes, procedures, techniques and technologies and also filed several patents. They have also organised seminars/ symposiums/ workshops and published research papers / reports / books.

5. FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

Government has evolved, from time to time, fiscal incentives and support measures to encourage R&D in industry and increased utilisation of locally available R&D options for industrial development. New incentives to encourage investments in R&D by industry are announced in the Union Budget.

Fiscal incentives and support measures presently available include:

- Income-tax relief on R&D expenditure;
- Weighted tax deduction U/s 35 (2AA) of IT Act 1961 for sponsored research programs in approved national laboratories, universities and IITs;
- Weighted tax deduction u/s 35(2AB) of IT Act, 1961 on in-house R&D expenditure in chemicals, drugs, pharmaceutical (including clinical drug trials, obtaining approvals from any regulatory authority under any Central, State or Provincial Act and filling an application for a patent under Patent Act, 1970), bio-technology, electronic equipment, automobiles and its components; computers, telecommunication equipment and manufacture of aircrafts and helicopters as approved by the Prescribed Authority (Secretary, DSIR)
- Customs duty exemption on capital equipment, spares, accessories and consumables imported for R&D by approved institutions/SIROs;
- Customs duty exemption on specified goods (comprising of analytical and specialty equipment) for use in pharmaceutical and biotechnology sector;
- Excise duty waiver on indigenous items purchased by approved institutions/ SIROs for R&D;
- Ten year tax holiday for commercial R&D companies approved upto 31.03.2007
- Excise duty waiver for 3 years on goods produced based on indigenously developed technologies and duly patented in any two of the countries out of India, European Union (one country), USA and Japan;
- Accelerated depreciation allowance on plant and machinery set-up based on indigenous technology;
- Customs duty exemption on imports for R&D projects supported by Government.

Information on some of these fiscal incentives is given in the following paragraph.

5.1 Depreciation Allowance on Plant and Machinery Setup Based on Indigenous Technology

Secretary, DSIR, Ministry of Science and Technology, is the Prescribed Authority to certify expenditures where higher rate of

depreciation is to be allowed for the plant and machinery using indigenous know-how as per provisions of rule 5(2) of IT Rules. Guidelines have been issued for making applications for obtaining the aforesaid certificate. All such applications received are examined in the department, and discussions and visits by experts to verify the claim are made to the plants by expert teams. Based on a detailed examination, certificates in deserving cases are issued for eligible expenditure.

During the year 2007, 5 certificates involving Rs.6797.7 lakhs on cost of plant and machinery were issued by DSIR. Details are given at **Annexure 6.**

5.2 Reference Under Section 35(3) of Income-Tax Act, 1961 Regarding Scientific Research

In the implementation of various incentive schemes for the promotion of research and development, the Income-tax Act, inter-alia, provides that expenditure made on capital equipment and related to research activities are allowed to be written off 100% in the year in which the expenditure are incurred. The Government has provided that if a question arises under section 35 of Income-tax Act, 1961 as to whether and, if so, to what extent any activity constitutes or constituted or any asset is or was being used for scientific research, the Central Board of Direct Taxes would refer the question to the Prescribed Authority. Director General Income-tax (Exemptions) in concurrence with Secretary, DSIR is the Prescribed Authority for deciding such cases. On receipt of the reference in DSIR, the department collects information/ background regarding the description of the activity claimed as scientific research, date of commencement of the relevant projects, date of completion of research work as also the results obtained from the specific project. After obtaining all these details, the matter is examined in DSIR. In case where it is considered necessary, a team of technical experts is constituted for on the spot appreciation of the research work done at the premises of the company. After receiving the technical assessment report from the visiting team, a discussion is also normally held so that the point of view of the Company is taken into account before arriving at a decision. After completing the processing of the case in the above fashion, the case file is placed before the Secretary, DSIR for giving a decision. The Secretary, DSIR gives his decision by setting out a reasoned order duly signed by him, which is communicated, to Director General (Income-tax Exemptions).

During the year 2007, request of one company has been under consideration.

5.3 Approval of Commercial R&D Companies

In order to promote research and development activities in the commercial research and development companies, the Finance Act, 2000 provided for a ten-year tax exemption from income-tax under section 80-IB(8A) of the Income-tax Act, 1961, to approved companies, whose main objective is scientific and industrial research. Secretary, DSIR is the Prescribed Authority vide Gazette notification no. S.O.85 (E) dated 31 January, 2001, issued by Department of Revenue, Ministry of Finance for granting approval under section 80IB(8A) of the IT Act. The notification was valid upto 31st March, 2007 and this scheme was not extended further by the Government.

The approval to commercial R&D companies is given initially for a period of 3 years, which can be extended up to 10 years based on evaluation of its performance.

The tax exemption is available to a company, which is accorded approval by the Prescribed

Authority at any time after the 31st day of March 2000 but before the 1st day of April 2007. So far, 45 R&D companies have been approved including 13 approved during the year 2007. Details are given at **Annexure -7.**

5.4 Customs Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR are eligible for Customs Duty Exemption on the import of scientific equipment, instruments, spares, accessories as well as consumables for research and development activities and programmes.

The procedure for issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions has been formalised. A Committee was set up in DSIR to examine the applications received from SIROs. The committee met periodically to examine the requests. The recommendations of the Committee were put up to the Head of the Industrial R&D Promotion Programme, for approval. As per the new notification No. 24 /2007 dated 1st March, 2007 the director or head of the institute / organization is empowered to sign the essentiality certificate.

5.5 Central Excise Duty Exemption to Recognised SIROs

All SIROs recognised by DSIR are eligible for Excise Duty Exemption on purchase of scientific and technical instruments, apparatus, equipment (including computers); accessories and spare parts thereof and consumables; computer software, Compact Disc - Read Only Memory (CD-ROM), recorded magnetic tapes, micro films, microfiches; and prototypes for research and development activities and programmes.

This provision was introduced by Ministry of Finance (Department of Revenue) vide notification No. 10/97-Central Excise dated 1st March, 1997. A Committee was set up in DSIR to examine the applications received. The Committee met periodically and essentiality certificates were issued with the approval of Head of RDI Scheme. As per the new notification No.10/ 2007 dated 1st March, 2007 the director or head of the institute / organization is empowered to sign the essentiality certificate.

5.6 Registration of Public Funded Research Institutions, Universities, etc.

Public funded research institutions, universities, IITs, IISc., Bangalore; Regional Engineering Colleges (other than a hospital) are eligible for availing customs duty exemption on import of equipment, spares and accessories and consumables for research purposes through a simple registration with the DSIR. The head of the public funded research institutions / organisations duly registered with DSIR can certify the R&D goods for duty free import as per the notification No. 51/96-Customs dated 23 July 1996. As per the Government notification No. 10/97-Central Excise dated 1.3.1997, the above Public Funded Research Institutions registered with DSIR are also eligible for Central Excise Duty Waiver on purchase of indigenously manufactured items for scientific research purposes.

Coinciding with the presentation of Union Budget for the year 2004, Ministry of Finance amended the notification No. 51/96-customs vide notification No. 28/2003-Customs dt. 1.3.2003. As per the amendment, departments & laboratories of central government and state governments (other than a hospital) are not required to register with DSIR for availing the customs duty exemption. They can clear the consignments by producing a certificate from the Head of the institution certifying that

the said goods are required for research purposes only. Another significant change in the notification is that regional cancer centres (cancer institute) have been included in the list of institutions eligible for DSIR registration for importing goods for research purposes at a concessional rate of customs duty of 5%.

The registration of above institutions is recommended by an inter-departmental Screening Committee constituted by the department for considering the requests from various institutions. The Screening Committee met 3 times during the year and considered 35 applications from various public funded research institutions.

During the year 2007, 28 registration certificates were issued to such public funded research institutions for availing customs duty exemption on import of scientific equipment, spares and accessories, consumable items and Central Excise Duty exemption on indigenous purchases for Scientific Research Purposes.

The registration to public funded research and other institutions mentioned in the notification is granted for maximum period of five years. The registered institutions are advised to apply for renewal of registration well in advance of the date of expiry of the registration.

During the year 2007, 70 institutions were due for renewal of registration. The department received 66 renewal applications. These were processed on individual files and approval of Secretary was obtained and 60 renewal certificates were issued ;and 2 cases were rejected as these are now not falling under the definition of Public Funded Research Institutions. The remaining applications are under process.

5.7 Approval of In-house R&D Centres u/s 35(2AB) of I.T. Act 1961

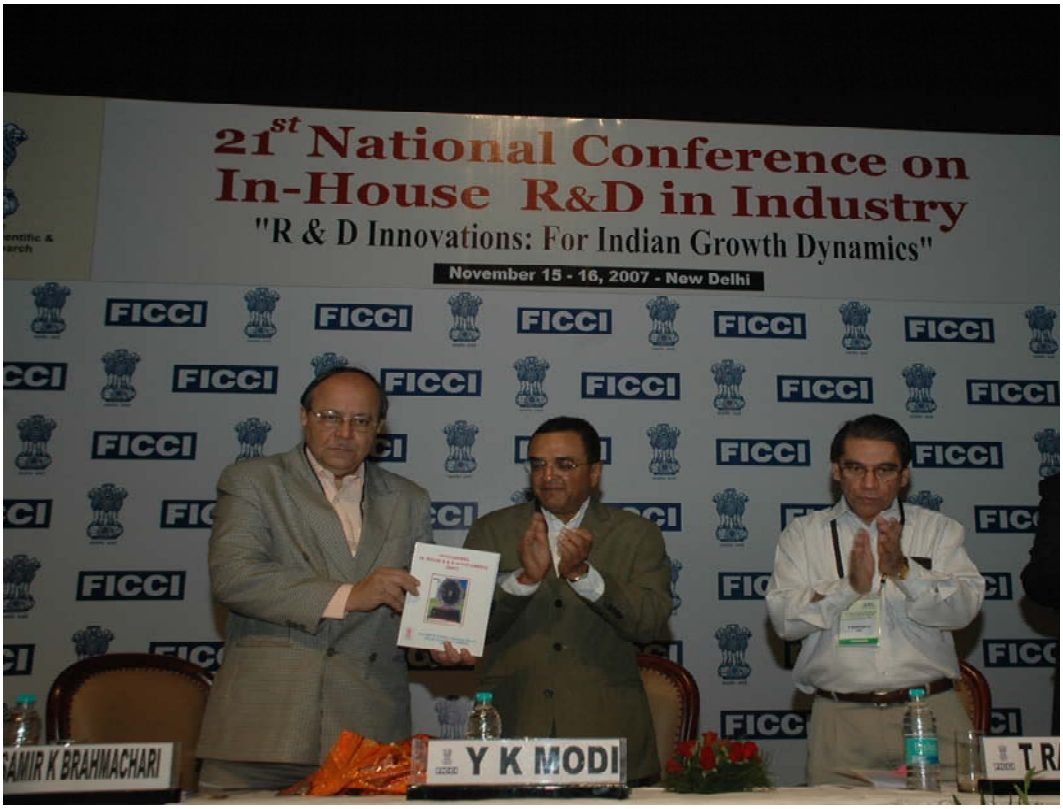
Finance Act 1997 introduced a sub-section (2AB) in Section 35 of the IT Act 1961. This sub-section was introduced in order to encourage research & development in drugs, pharmaceuticals, electronic equipment, computers, telecommunication equipment, and chemicals. The sub-section provided for weighted tax deduction of a sum equal to one and one-fourth times of any expenditure incurred on scientific research (not being expenditure in the nature of cost of any land and building). The weighted tax deduction was further raised to 150% by the Finance Act, 2000. The in-house Research and Development facilities of the companies engaged in the business of manufacture or production of the above said items should be approved by the 'Prescribed Authority' i.e. Secretary, DSIR. Also, the company should enter into an agreement with the Prescribed Authority for co-operation in such research and development facility and for audit of the accounts maintained for that facility. Through a separate notification, manufacture of aircrafts and helicopters was included in the list eligible under this section.

The provision was introduced for expenditure on R&D incurred up to 31st March 2000. The Ministry of Finance, Department of Revenue, Central Board of Direct Taxes, notified the provision vide Notification No. S.O.259 (E) dated 27 March 1998. Finance Bill 1999 introduced in Lok Sabha on 27 February 1999 extended this provision till 31 March 2005. The provision was further extended upto 31.03.2007 by the Finance Act 2005 and again upto 31.03.2012 by the Finance Act 2007. The sub-section was amended by the Finance Bill 2001, to include expenditure on in-house R&D by units engaged in the business of biotechnology, as well as cover expenditure on clinical trials, filing of patents

under Indian Patent Act (1970) and obtaining regulatory approvals, for weighted tax deduction @ 150% under section 35(2AB) of Income-tax Act. During the year 2004, CBDT has notified automobile including automobile components as an article or thing eligible for the weighted deduction under the section 35(2AB) of IT Act.

During the year 2007, 43 new applications for approval in Form 3CM received by the Prescribed Authority. Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961. Fresh / renewal of approval were accorded to 82 companies by the prescribed authority. These approvals were communicated in Form 3CM, after Agreements of cooperation for research & development were signed with these companies on behalf of the Secretary, DSIR. Further, the detailed R&D expenditures of the approved companies have also been examined by DSIR and 61 reports have been forwarded to DGIT(E) in Form 3CL as required under the IT Act. A list of companies approved under Section 35 (2AB) of IT Act, is furnished in **Annexure-8.**

An Award Winner Receiving the DSIR National R&D Award (2007)

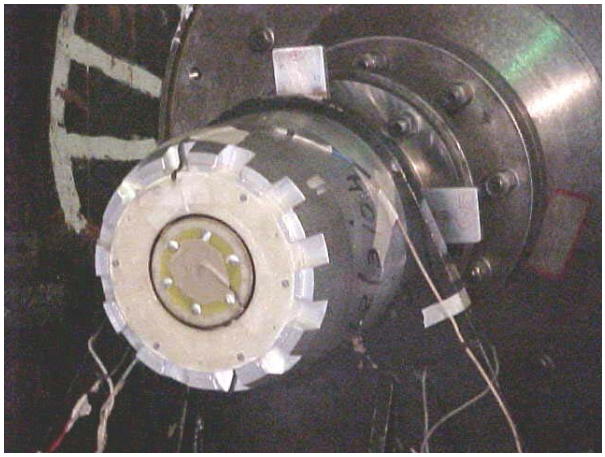


Prof. Samir K. Brahmachari, Secretary DSIR and Dr. T. Ramasami, Secretary, DST and Sh. Y.K. Modi, Ex President FICCI Releasing the DSIR Special Publication

Prof. Samir K. Brahmachari, Secretary, DSIR Inaugurating the 21st National R&D Conference

Dr. K.T. Chacko, Director Indian Institute of Foreign Trade, during the Valedictory Session

Recovery of Cyclohexane from waste RB bottom Stream in Polyethylene Manufacturing



12 channel rotary telemetry system mounted in the rig for spin test

II-B. TECHNOLOGY DEVELOPMENT AND INNOVATION PROGRAMME

The programme has two sub-components, viz. (i) **Technology Development and Demonstration Programme (TDDP)** to support technology development efforts of industry – R&D system and (ii) **Technopreneur Promotion Programme (TePP)** to nurture the innovative spirit of individuals.

1. TECHNOLOGY DEVELOPMENT & DEMONSTRATION PROGRAMME

1.1 Objectives

The programme aims at catalyzing and supporting activities relating to technology absorption, adaptation and demonstration including capital goods development, by involving industry and R&D organization. The specific objectives of the programme are:

- Supporting industry for technology development, demonstration and absorption of imported technology
- Building indigenous capabilities for development and commercialization of contemporary products and processes of high impact.
- Involvement of national research organization in joint projects with industry
- Technology evaluation in selected sectors

1.2 Activities

The Department provides, on a selective basis, partial financial support to research, development, design and engineering (RDDE) projects proposed by industry in the following areas:

- Development and demonstration of new or improve product and process technologies including those for specialized capital goods, for both domestic and export markets.
- Absorption and up-gradation of imported technology.

The partial financial support by DSIR in the above areas, primarily covers prototype development and pilot plant work, test & evaluation of products from such R&D, user trials, etc. Bulk of the cost of the project is met from industry's resources. TDDP has now been expanded by adding two more components, namely "TDDP-Start Up" and "TDDP-Small Business" under which support would be provided, as the name indicates, to Start Up companies to start their commercial operations and to small business to carry out both lab/pilot scale R&D as well as commercialization.

The Department, under this activity has so far supported about 193 R&D projects of Industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives, etc. 111 projects have so far been completed and over 35 technologies developed under the scheme have been commercialized or under commercialization. During the year, 52 Technology Development Demonstration projects supported under the scheme were reviewed for progress.

The list of running projects of various industrial units are given in **Annexure 9**. The details of new projects approved during the year are given below:

Microbial Production of Arachidonic Acid, An Omega-6 Polyunsaturated Fatty Acid Essential for Human Health, submitted by M/s ABL Biotechnologies Ltd., Chennai

Arachidonic Acid (ARA) is a polyunsaturated fatty acid and is a precursor of eicosanoids. Eicosanoids, which are made by oxygenation of twenty-carbon essential fatty acids, (EFAs) are signaling molecules that act as messengers in the central nervous system and also exert complex control over many bodily systems, principally in inflammation or immunity. Absence of ARA or such other polyunsaturated fatty acids can lead to many and varied disorders such as pre-menstrual syndrome, schizophrenia, rheumatoid arthritis, multiple sclerosis, etc. ARA is also deemed as essential for the healthy development of the brain in infants and, to this end, is recommended in infant foods together with other polyunsaturated fatty acids such as docosahexaenoic acid (DHA).

ARA is an essential requirement of most mammals and for many mammals, the requirement is met by converting linoleic acid. Plants and plant oils do not contain ARA, and at present, the commercial source of this important fatty acid is a group of fungi belonging to the genus Mortierella. Many patents have been taken on individual strains of the fungus as well as the use of ARA in various formulations.

The present project proposes to establish a high yield strain of the fungi available in the Indian sub-continent and to optimise the conditions for the growth of this culture with a view to scale up for commercialisation. When they succeed, it will be for the first time that a commercial production of ARA would be set up in India.

This project has been supported by DSIR with a support of Rs. 180 Lakhs out of a total project cost of Rs. 471 Lakhs.

Development of Process for the Manufacture of Nano Labeled DNA/RNA Compounds, submitted by M/s Ogene Systems (I) Pvt. Ltd., Hyderabad

The labelling compounds that are referred to above are used in research for gene expression, automated nucleic acid synthesis/sequencing, quantitative PCR and in situ hybridization. It is believed that the nano-labelled compounds proposed to be developed under the project are the latest state-of-the-art second generation compounds with such a high level of sensitivity that they could enable the detection of the presence of even a single molecule in the sample. The technology for the production of such compounds has been developed at laboratory scale by M/s BioGenex of USA. Ogene proposes to commercialise this technology.

The proposal has been supported by DSIR with a support of Rs. 110 Lakhs out of a total project cost of Rs. 308 Lakhs.

Development of Novel Therapeutics based upon Natural Products from Indian Medicinal Plants, Joint Project Proposal of Chemistry Department, Delhi University, and VP Chest Institute, University of Delhi, Delhi

The proposal proposes to identify natural product based molecules which have better efficacy than the compounds already identified till now. The proposal also includes medicinal chemistry analysis on potential anti-inflammatory, and anti-platelet aggregation and vasorelaxation compounds already identified by them.

The proposal has been supported by DSIR with a support of Rs. 226 Lakhs out of a total project cost of Rs. 226 Lakhs.

Green Process Technology for the Manufacture of Cephalosporin G, Submitted by Orchid Chemicals & Pharmaceuticals Ltd., Chennai

Cephalosporins are bactericidal and belong to a group of beta-lactam antibiotics (such as penicillins). Like other beta-lactam antibiotics, they inhibit the synthesis of a structural component of the bacterial cell wall. In the case of Cephalosporins, they disrupt the synthesis of the peptidoglycan layer of bacterial cell walls.

Cephalosporins are much more expensive than penicillins. One reason is that some cephalosporins are made from penicillins by a number of chemical conversions. One of the necessary chemical steps involves the expansion of the 5-membered penicillin ring structure to a 6-membered cephalosporin ring structure. This complex chemical processing is both expensive and noxious to the environment. Another reason is that, so far, only cephalosporins with a D-5- amino-5-carboxypentanoyl side chain, such as Cephalosporin C, could be fermented. Cephalosporin C, by far the most important starting material in this respect, is very soluble in water at any pH, thus implying lengthy and costly isolation processes using cumbersome and expensive column technology. Being less potent, Cephalosporin C obtained in this way has to be converted into therapeutically used cephalosporins by a number of chemical and enzymatic conversions.

Cephalosporins are antibiotics characterized by a cephem ring system in which a beta−lactam ring is fused to a dihydrothiazine ring. The cephem ring system is synthesized by expansion of the five−membered thiazolidine ring of the penicillin to the six−membered dihydrothiazine ring. The enzyme that catalyzes this reaction is the deacetoxycephalosporin C synthetase (DAOCS)—often called expandase. This has been covered under numerous patents.

OCPL claims to have identified and developed competitive mutants of expandase, which would not only be proprietary but also commercially relevant and have filed for intellectual protection by its applications ((Modified expandase enzyme and its use - India, 366/CHE/2004, 22.04.04; India, 838/CHE/2004, 23.08.04; PCT, IB05/01040, 20.04.05). PCT, IB05/01040, 20.04.05 application has been cleared for filing with individual countries.

They have completed laboratory scale trials and now propose to go in for pilot scale trials before going on for commercialization. A successful outcome in the project could enable OCPL to play a dominant role globally in this area.

The proposal has been approved by DSIR and the agreement is under negotiation.

2. TECHNOPRENEUR PROMOTION PROGRAMME (TePP)

Department of Scientific and Industrial Research (DSIR) under its Technology Development and Innovation Programme of TPDU Scheme and Technology Information Forecasting and Assessment Council (TIFAC) of Department of Science and Technology (DST) jointly operate "Technopreneur Promotion Programme (TePP)". TePP endeavour to tap the vast innovative potential of the citizens of India. Financial support is provided to individual innovators having original ideas to convert them into working models, prototypes etc. It is expected that

thirty new projects would be supported during the whole financial year of 2007-2008 by DSIR. The details of the completed, on-going and approved projects supported under TePP during the year under report are given in **Annexure 10**.

3. OTHER ACTIVITIES

3.1 To expand the reach of TePP among common mass, **ten** TePP Outreach Centres of DSIR were set up at Sponsored Research and Industrial Consultancy (SRIC), IIT Kharagpur (W.B.), Society for Innovation and Entrepreneurship (SINE), IIT Bombay, ERDC-Hartron, Ambala Cantt. (Punjab), Acharya Nagarjuna University, Guntur (A.P.), Technopark, Trivandrum (Kerala), Foundation for Innovation & Technology Transfer (FITT), IIT Delhi, Shri Siddhartha Institute of Technology (SSIT), Tumkur (Karnataka), Science & Technology Entrepreneurs' Park(STEP)- National Institute of Technology(NIT), Surathkal (Karnataka), TREC-STEP, Trichy (T.N.) and JSSATE-STEP, NOIDA(U.P.). Besides these, six additional TePP Outreach Centres were also set up by TIFAC at PSG-STEP, Coimbatore, Vellore Institute of Technology- Technology Business Incubator (VIT-TBI), Vellore, Central Glass Ceramics Research Institute(CGCRI), Kolkata, Institute Industry Partnership (IIP) Cell, IT-BHU, Varanasi and SIDBI Innovation & Incubation Centre (SIIC), IIT Kanpur, Kanpur, IIT Roorkee and College of Technology & Engineering, Udaipur (Rajasthan).

3.2 With a view to sensitize larger mass, **nine** TePP Innovation Funding Camps were organised at Kanpur (6th April), Karad (13th April), Satara(14th April), Patna (21st April), Bhopal (28th April), Baddi (17th May), Mohali (18th May), Jabalpur (28th July) and Sholapur respectively.

3.3 DSIR participated/ organised in a number of exhibitions/ workshop to showcase the strengths and capabilities of R&D projects supported under TePP as well as to sensitize academia and network partners about the philosophy of TePP during the year.

- An interaction meet of TePP officials with family business managers was organized on 4th April, 2007 at S.P. Jain Institute of Management & research, Mumbai.
- TePP participated in All India Junior Robotics Championship – TRICS, 2007 at IIT Bombay on 29th April, 2007 to create awareness among young children about TePP scheme.
- TePP participated in India Innovation Summit at Bangalore organized by Confederation of Indian Industry(CII), Southern Chapter, June 15-16, 2007, wherein products/working models of TePP innovators were displayed.
- TePP Orientation Programme for Representatives of TePP Outreach Centres at SIDBI Innovation & Incubation Centre(SIIC), IIT Kanpur, July 30-31, 2007.
- 2-day training programme on "Creativity and Problem Solving" at TIFAC, New Delhi, September 26-27, 2007.
- Two (2) brain-storming sessions were organized to explore the possibilities for setting up "Innovation Export Promotion Council" in association with CII, Gurgaon at FITT, IIT Delhi on 28th September, 2007 and at Indian Institute of Management Bangalore on 22nd October, 2007.
- Business Plan Competition "METAMORPHOSIS" in association with Indian School of Business(ISB), Hyderabad is being organized for select TePP innovations. The final of the event

has been planned to be held on 17th December, 2007 at Hyderabad.

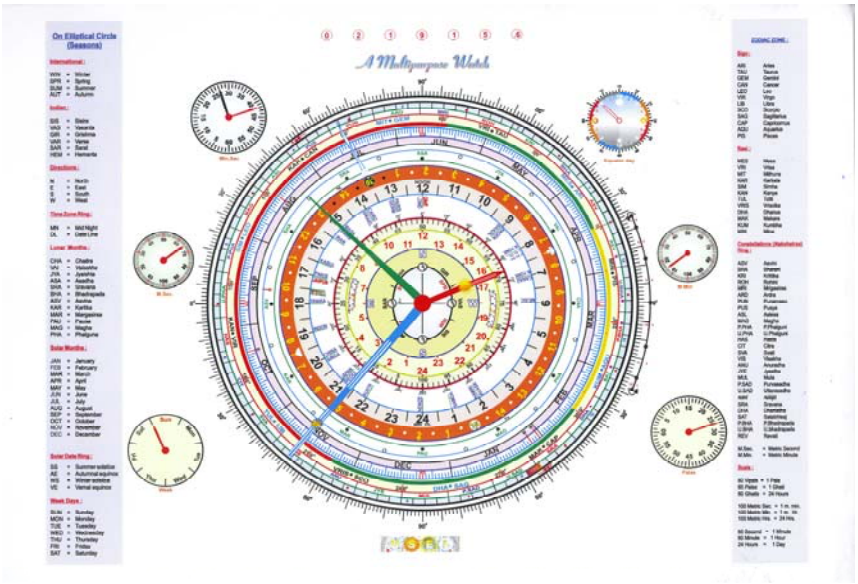
The aim of these activities were to disseminate information on TePP to its clientele.

3.4 To diffuse the achievements of TePP innovations, a publication entitled "CREATIVE INDIA, Vol. II" consisting 51 profiles of innovators was published and distributed among concerned groups.

3.5 To make wider dissemination of TePP through print media as well as to solicit proposals from independent innovators, network partners, an advertisement was given in around 150 newspapers in leading national dailies and regional newspapers.

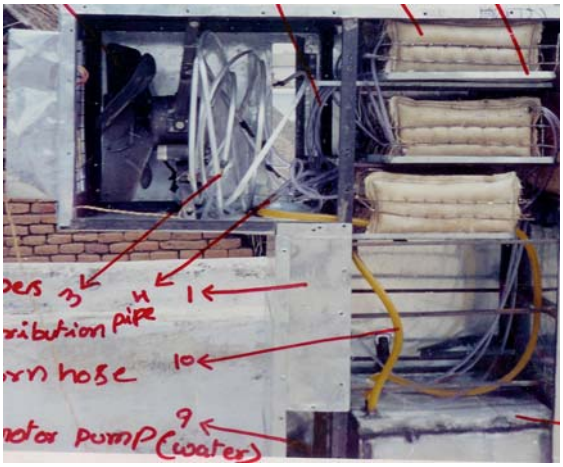
Mobile operated remote switch

Hybrid system for solar distillation and drying application



A Multipurpose Watch, http://www.uselwatch.com

Digital Talk Friend(STF) for Speed Warning and Limiting Device



Natural air cooler

II-C. TECHNOLOGY MANAGEMENT PROGRAMME

1. PREAMBLE

The Technology Management Programme continued its operations during the year 2007-08 and completed a number of activities that were targeted for the year.

2. OBJECTIVES

The major objective of the Programme is to provide technical inputs and support mechanisms for efficient transfer and management of technology. Technology management aspects have gained special significance in the current era of intense technological competition. The programme is, therefore, aimed at enhancing technology management capability in industry, R&D and consultancy organizations, academic institutes and other establishments.

3. ACTIVITIES

The activities under the programme are aimed at enhancing knowledge and skills in the efficient management and transfer of technology. The major activities undertaken are aimed towards:

- Enhancing knowledge base in respect of technologies specific to the nation, including rural based technologies and region/sector specific technologies by undertaking analytical studies, technology status and development studies;
- Providing information to industry, Government departments and researchers through targeted research studies and policy research;
- Promoting industry-institute interaction by setting up resource centers on technology management in appropriate locations;
- Curriculum development exercises;
- Enhancing academic interest and contribution through active collaborations and memorandums of understanding with academic institutes;
- Providing assistance in efficient transfer of technology, through information in respect of foreign collaborations approved and analysis of such approvals as well as focused studies;
- Initiating state level agencies and research organizations to take up activities in the realm of Technology Management;
- Information dissemination on Technology Management related aspects through newsletters, manuals, and other forms
- Promoting an understanding of Technology Management in the Indian scenario through case studies of manufacturing and research organizations in the country, etc.
- Conducting awareness programmes, focused training courses, seminars and management development programmes, and providing guidance to trainers.

4. WORK COMPLETED/UNDER-TAKEN DURING THE YEAR

During the year, in addition to the on-going work, some more need based programmes and activities have been taken up.

4.1 Analytical, Technology Status and Development Studies

Sector-specific and region-specific studies of technologies, including rural based technologies are important in identifying technology gap, ensuring technology transfer and enhancing efficiency of industries. Some of the studies which have been completed/ undertaken under this category include the following:

Studies on 'Potential of Minor Forest Produce (MFP) based industries in select regions'

Status studies of minor forest produce (MFP) and industries based on non wood forest produce of select regions have been undertaken. The study pertaining to the State of Gujarat has been taken up by Gujarat Industrial and Technical Organization Ltd. (GITCO); that of Tamil Nadu by Industrial and Technical Consultancy Organization of Tamil Nadu Ltd. (ITCOT); that of West Bengal by West Bengal Consultancy Organization Ltd., (WEBCON) Kolkata; and that of Andhra Pradesh by APITCO, Hyderabad. The reports are the outcome of surveys carried out in the respective States to assess the availability of MFP and also to assess the industries which are dependent on MFPs as raw materials for their industries. The studies analyze the status of technologies available in the region of concern and suggest measures towards generation of value added products based on MFP as raw material. Select project profiles relevant to the specific regions have also been brought out. The findings of the studies on Potential of MFP in Gujarat, and Tamil Nadu have been widely disseminated through the organization of workshops in Ahmedabad and Coimbatore respectively.

Study on Status of Technology and Scope of Technology Improvement in Handloom, Powerloom, Readymade Garments Sector in West Bengal by West Bengal Consultancy Organization Ltd. (WEBCON), Kolkata

The objective of the study taken up by West Bengal Consultancy Organization Ltd. (WEBCON), Kolkata was assessment of technology status and scope for improvement in the handloom, power loom and ready made garments sector in West Bengal. The report has brought out an overview of the handloom, powerloom and readymade garment industries in West Bengal, technologies in use and technologies for improvement of these sectors. It includes a SWOT analysis of the technologies and the practices in use, brings out the availability of newer technologies, issues involved in marketing, raw material, infrastructure, etc. for improving the productivity in these sectors.
The findings of the study have been widely disseminated through a workshop organized in Kolkata during the year.

Study on development of beel fisheries and various species of bamboo in NE states

The study has been entrusted to the North Eastern and Technical Consultancy Organization Limited (NEITCO), Guwahati. The draft report brought out by NEITCO was discussed in an Evaluation Committee Meeting comprising of concerned Government Departments, industry and academic representatives, research agencies and experts. The report is based on an analysis of data collected on quantitative availability and characteristics of various species of bamboo as well as beel fisheries in the whole of northeastern region. Conclusions have been drawn and recommendations indicated to better the prospects of the involved agencies and individuals, both in the short term as well as in the long term.

Study on Status of Technology in Castor Oil & its Derivatives in India

The study has been entrusted to Gujarat Industrial & Technical Consultancy Organization Ltd. (GITCO), Ahmedabad. The objective of the study is to assess technology status and scope for improvement in the production of Castor Oil & its Derivatives in India. The report will broadly bring out an overview of the Castor Oil & its Derivatives in India, technologies in use, technologies for improvement of these sectors, research and development, a SWOT analysis of the technologies and the practices

in use, bring out the availability of newer technologies, issues involved in marketing, raw material, infrastructure, etc. for improving the productivity in these sectors. The project is in progress.

4.2 Studies on Technology and Innovation Management Issues

Technological dynamism has become the order of the day and new approaches; tools and techniques are being developed in technology and innovation management areas. Studies in such emerging areas for harnessing knowledge creation, technology transfer and technology up-gradation, have been taken up. These are listed below:

Study on the status and prospects of Industry-Institute Collaborations in Emerging Technologies by Confederation of Indian Industry (CII), Gurgaon

The study has been entrusted to Confederation of Indian Industries (CII), Gurgaon. The basic objective of the study, the status and prospects of industry-institute collaborations in the field of nano technology. The draft report brought out by CII was discussed in an Evaluation Committee Meeting attended by concerned industry representatives and experts. The report was revised on the basis of the recommendations made at the Meeting. The final report has been brought out and the project has been completed.

Study on 'Management of Technology in the Automotive sector'

The study was assigned to Management Development Institute (MDI), Gurgaon. The main objective was to study aspects related to management of technology in the automotive sector that have potential to grow and develop further in the country, and suggest measures for furthering innovations in this vibrant sector. The report has based its analysis on general developments in the Indian automotive industry sector and on cases of technology development and innovations carried out by Sona Koya Steering Systems, Hero Honda. The report includes a case study of technology forecasting and assessment relating to use of magnesium in automobile vehicles. The study has been completed and the final report has been received.

Study on 'Social Capital and Technology'

The study has been undertaken in association with T A Pai Management Institute (TAPMI), Manipal. The study report is an outcome of research and analysis on the manner in which technology has shaped and continues to shape social capital among professional groups. Both a qualitative as well as a statistical analysis has been undertaken, as part of the project. The report concludes that Information and Communication Technology related developments have decisive impact on social capital. The research has indicated that social capital does promote better utilization of other forms of capital such as finance and human capital. The survey findings in respect of inter organizational linkages have led to an understanding of how ICT technologies can be dealt with to enhance social capital, which is seen to be an important organizational asset. The project has been completed.

Technology audit of Fish Processing Industry in the Coastal Districts of Karnataka

The project has been taken up by NITK Science & Technology Entrepreneurs" Park, Karnataka. The objective is to assess the existing practices of fish harvesting being deployed along the coastal districts of Karnataka and to suggest innovative and cost effective technologies for the same. An analysis of the present status of post harvest technologies in the region is also included. The draft report brought out by NITK-STEP was discussed in an Evaluation Committee

meeting comprising of representatives of concerned Government Departments, industry, academic and research organizations. Workshops have been organized to disseminate the findings. The report is under finalization.

4.3 Targeted Research Studies on Specific Issues in Technology Transfer and Innovation Management

There is need for serious research on management of technology in different sectors to develop an objective understanding of complex situations demanding a focused direction. Such research efforts not only result in comprehensive information of a specific nature but also enable objective decision-making. The studies undertaken during the year in this regard are listed below:

Study on 'An empirical analysis of the status of collaborative R&D in India'

The study has been entrusted to IIM Indore. The main objective of the study is to understand the perception of Indian industries related to collaborative R&D, identify the factors that impede Indian industry from carrying out collaborative R&D, estimate the impact intensity of these factors on the probability of adopting collaborative R&D and bring out the difference across industries as well as technologies, in this regard. The draft report brought out by IIM Indore was evaluated by an Evaluation Committee comprising of representatives of concerned agencies and experts. The report has been finalized based on the recommendations of the Committee.

Study on 'Managing strategic transformation of high-tech firms in India'

The study has been entrusted to IIM Calcutta. The broad objective of the study is to research into the process of strategic transformation by companies that wish to move up the value chain, in the case of two specific industries, namely the pharmaceutical and information technology. The draft report was discussed in an Evaluation Committee. The findings indicate that a number of IT companies and Pharmaceutical firms have made strategic moves to be at the forefront of global leadership by making use of emerging opportunities. The report is under finalization.

Study on 'Building technological capabilities through strategic development of industrial clusters'

The study has been entrusted to IIM Ahmedabad. The project aims to broadly study the mechanisms that firms use to learn from each other in order to enhance their technological capabilities and consequently their competitiveness and identify what allows clusters to achieve this objective. The draft report submitted was discussed in an Evaluation Committee Meeting. The report brings out important factors involved in determining capabilities and productivity in clusters; and includes an analysis of the structure of the cluster – size distribution, characteristics of entrepreneurs, product composition and location in the cluster life cycle. The report has been finalized and the project has been completed.

Research Study on Competitiveness Evaluation for Emerging Technologies

This study has been taken up by Department of Management Studies, IIT Delhi. The basic objective of the study is to identify key elements of a strategy to enhance competitiveness of emerging industries; understand the dynamics of competitiveness in emerging industries of different countries; understand the dynamics of competitiveness in emerging industries to identify key success factors, and evolve criteria of evaluating competitiveness of the industries and assess the availability, cost and quality of data for

the purpose. The final report of the study has been received and its findings have been disseminated in a workshop organized in collaboration with IIT, Delhi and IIT, Bombay in Mumbai.

Study of Knowledge Management in Auto Component SME Clusters in the NCR Region

The project has been taken up by Institute for Integrated Learning in Management (IILM), New Delhi. Objective of the study the current status of knowledge management practices in the Auto Component SME Clusters covering the aspects of technology, process and people of knowledge management and to identify strength and weaknesses in knowledge management practices in this sector. An Evaluation Committee comprising of concerned experts and representative industry, academic and Government organizations reviewed the draft report. The report is under finalization.

4.4 Case Studies covering Technology Management aspects

The objective is to generate learning from best practices and to study and analyze the manner in which technology is managed in Indian enterprises. Apart from being useful for pedagogic use, these case studies also provide useful information to consultants and executives from industry.

Case Studies on Industrial Clusters by IIT, Kanpur

Case Studies on select industrial clusters in the State of Uttar Pradesh has been taken up in association with IIT, Kanpur. The objective is to understand and document the issues that underline the sustained competitive advantages of three clusters – the leather processing cluster of Kanpur, the silk producing cluster of Varanasi and the brass work cluster of Moradabad. The draft report has been discussed in an Evaluation Committee meeting and the report is under finalization.

4.5 Collaborative Work with Academic and Research Institutes

In order to give the necessary thrust to formal education and develop a base of teaching tools on technology management aspects, the Department has been collaborating with academic institutes, especially those concerned with technical and management education. Different activities, inclusive of management development programmes and projects on technology and innovation management in association with IIM Ahmedabad, IIM Kolkata and IIM Indore are under progress. Work taken up at IIT Bombay, IIT Kanpur, IIT Delhi, IIT Madras has progressed. Projects undertaken in partnership with other institutes, including ASCI Hyderabad, IISc Bangalore, PSGIM Coimbatore, NITK, Management Development Institute Gurgaon, T.A. Pai Management Institute Manipal and others have also under progress.

4.6 Industry-Institute Networking with State Level, Research and other Agencies on Technology Management

Interactions with several State level bodies across the country were continued apart from continuing the existing collaborations with research institutions. Collaborative activities have been taken up in partnership with Madhya Pradesh Council of Science & Technology, Karnataka Council for Technological Upgradation, different State level Technical Consultancy Agencies including MPCON Bhopal, APITCO Hyderabad, NEITCO Guwahati, MITCON, Pune, GITCO Ahmedabad, ITCOT Chennai, WEBCON Kolkata and CDC New Delhi.

4.7 Centres for Technology Management (CTM)

Centres for Technology and Innovation Management have been set up in different locations of the country where there is access to information on aspects concerned with the subject that are of specific interest to the region of concern, expertise to advise and provide guidance on issues concerned with technology management, and generate long-term as well as short-term solutions. The activities taken up have been wide ranging: training, research, cluster development studies, case studies, scouting innovation, manpower development, interfacing between academia and industries, data generation, sharing of knowledge and providing solutions to industries, preparation of technology related policy studies, developing training tools and modules.

Centre for Technology Management (CTM) at PSG Institute of Management, Coimbatore

Phase III of the project is currently underway. The activities completed in Phase I & II include: development of a local data base of select industry SME units, three work studies and two case studies and organization of 6 workshops/seminars, publication of a booklet on Patent Procedures, twelve issues of CTM newsletter and Study on 'Technology Upgradation in Pump Industry'.

Survey on Common Modern Tool Room, preparation of audio visuals on technology management related aspects and augmentation of the content of the TM portal are in progress. Some of the programmes and publications are in the vernacular medium, so that the local SME industry participants at various levels can also benefit from the activities of the Centre.

Centre for Technology Management at MPCOST, Bhopal

After successful completion of Phase-I activities under the Technology Management Centre, Phase-II activities were started. The activities proposed include need-based sectoral technology status studies, case studies, theme-oriented workshops on emerging issues concerning Technology Management, short-duration training programme on TM, bringing out quarterly newsletter, development of a portal on TM, scouting/trouble-shooting services to the industries on TM aspects, etc. Priority activities with respect to the need and relevance of the industry for the State of Madhya Pradesh are being taken up in consultation with the State functionaries and organizations.

Centre for Technology Management at IIT, Bombay

Work has been undertaken as set of collaborative activities under an MOU with the School of Management at IIT Bombay. Phases I and II had been completed earlier.. Phase III has now been initiated with Management Development Programme on R&D Management for industry executives and one newsletter issue. A Programme Advisory cum Monitoring Committee has been set up and has met to finalize the work content of the phase. Case studies of select organizations, augmentation of portal content, training of trainers programmes for academic and industry participants, management development programmes for industry executives and other activities are under implementation.

Centre at Karnataka Council for Technological Upgradation (KCTU)

Collaborative activities in association with the Karnataka Council for Technological Upgradation Bangalore, a joint venture

organization between the Central and Karnataka State Government, were continued. Cluster level case studies, focused training programmes, information dissemination of technology management aspects specific to the region and bringing out of newsletters are among the activities taken up during successful completion of phase I. An audio visual programme on Technology management, covering initiatives under the MOU with KCTU, has also been prepared. Phase-II has now commenced. Activities taken up include: studies on technology upgradation in select industry clusters of the State, training and human resource development, TM awareness programmes in targeted regions of the State, cases studies, preparation of audio visuals, and publications on TM.

Centre at Administrative Staff College of India, Hyderabad

Collaboration with Administrative Staff College for building institutional capability in Technology Management has been continued. Four phases covering a range of activities that have evolved over a period of time; including case studies of manufacturing and research organisations, technology policy studies, and training programmes on various TM issues; have been completed. Phase V has now been initiated comprising several activities that include a comprehensive Technology Management Case Study on a specific industry, Case Studies from Manufacturing Industry and research Organizations, Training Programmes on Technology Management aspects of two weeks duration each, Research Publications and augmentation of the Web enabled portal.

Centre for Technology & Innovation Management at IED Patna, Bihar

With the objective of developing technology management capabilities in the State of Bihar and to serve as a resource center, this Technology Management Centre is being set up at Institute of Entrepreneurship Development at Patna in Bihar. The project has been commissioned after completion of due formalities.

Centre for Technology & Innovation Management at IHBT, Palampur in Himachal Pradesh

With the objective of developing technology management capabilities in the State of Himachal Pradesh and adjoining areas to serve as a resource center, this Technology Management Centre is being set up at IHBT, Palampur in Himachal Pradesh. The project has been commissioned after completion of due formalities.

Support to the existing Centre of Innovation & Technology Management at IMI, New Delhi

With a view to develop technology management capabilities and create a greater awareness about Technology and Innovation Management, targeted training programme for trainers and awareness programme are being supported at IMI, New Delhi to be carried out by the existing Centre for Innovation & Technology Management at the institute. The project has been commissioned.

4.8 Curriculum Development

An initiative towards curriculum development in Technology management has been taken up and preparation of five course modules has prioritized. Each module consists of twenty topics and specific topic writers have been identified and task of writing had been assigned. Four course modules have been completed and the fifth one is under preparation.

4.9 Information Dissemination

To enhance understanding and appreciation of the importance of the aspects concerned with management of technology, mechanisms for

information dissemination on technology management aspects have been initiated. These include: Newsletters, Manuals, Paper contests on specific technology related issues, Compilations of articles, Audio-visual aids, Portals and others. Information that is region specific, or relating to globally world wide emerging aspects, or nationally important issues, or sector specific information and even general educative articles are all included to impart the requisite information and value, depending upon the actual medium or product, and its specific use.

Newsletters

Newsletters on specific technology management aspects in association with IIT Bombay, PSGIM Coimbatore, KCTU Bangalore and MAPCOST Bhopal, is being brought out regularly.

Electronic Newsletter

An electronic newsletter developed in collaboration with IIT Madras has been launched and eight issues have been published. The objective of the Newsletter is to enhance technological creativity and interest in technology development among various target groups. The newsletter features information on various technologies, case studies, and technology morphologies; and provide basic foundation on various aspects of technology management.

Portals for information dissemination

Portals and other interactive media have been developed in association with ASCI Hyderabad, IIT Bombay, PSGIM Coimbatore and other organizations and these are being continuously augmented to provide contemporary information on a periodic basis.

4.10 Training/ Interaction Meets/ Management Development Programmes

During the year, the following programmes were organized ;

- National Workshop on Leveraging Innovation for SME Competitiveness at Pune in collaboration with CDC, New Delhi and MITCON, Pune.
- National Workshop on Competitiveness in Emerging Industries at Mumbai in collaboration with IIT, Delhi and IIT, Bombay.
- National Workshop on Technology Status and Potential for Improvement in Handloom Powerloom and Readymade Garment Sectors in West Bengal at Kolkata in collaboration with WEBCON, Kolkata.
- National Workshop on Status and Potential for Minor Forest Produce based Industries in Gujarat at Ahmedabad in collaboration with GITCO, Ahmedabad.
- A National Workshop on Status and Potential for Minor Forest Produce based Industries in Tamil Nadu at Coimbatore in collaboration with ITCOT, Chennai.
- Interaction Meet under TM for Best Paper Contest in collaboration with Anna Malai University, Anna Malai Nagar.
- Seminar on Technology Management Programme for unorganized SSI sector through Agargami Handicapped Samity, West Bengal.
- A 6-month Training Programme in Technology Management in Food Technology, Herbal and Medicinal Plant Processing Technology and Information Technology for 30 candidates each in collaboration with Institute of Entrepreneurship Development, Patna.
- Management Development Programme on 'R&D Management' in collaboration with IIT Bombay for the benefit of industry participants.
- Training Programme for senior scientists on 'Technology Commercialization' in association with ASCI Hyderabad.

II-D. INTERNATIONAL TECHNOLOGY TRANSFER PROGRAMME

1. PREAMBLE

International Technology Transfer Programme (ITTP) is a component programme of 'Technology Promotion, Development and Utilization (TPDU) Programmes'. The programme has its genesis in Transfer and Trading in Technology (TATT) scheme, which was formulated in the seventh five year plan and continued till the ninth five year plan. ITTP has consolidated various technology export promotion activities of the earlier scheme and aims at encouraging and supporting Indian industry for greater participation in international technology trade.

2. OBJECTIVES

Promoting transfer of technologies, projects and services from India with a view to enhance the reach of Indian industry beyond the national boundaries as well as promoting transfer of technologies from other countries to India with a view to enhance the technology export capability of Indian industry.The major activities of the programme include:

- To compile information on exportable technologies and technology intensive projects, products & services available with Indian industry and R&D establishments;
- To create awareness about our technology export capabilities among potential foreign buyers or collaborators;
- To support capability building of industries and R&D establishments for technology intensive exports;
- To support research and analytical studies aimed at providing inputs to the government for technology export related policy formulation;
- To promote and support Institutional Mechanisms for catalyzing international technology transfer and trade; and
- To facilitate signing of MoUs / Agreements on High Technology Cooperation and Trade between Indian and foreign industrial units.

3. PROJECTS/ACTIVITIES DURING THE YEAR 2007-08

Details of important projects/activities that were completed or were in progress during the year under report are given below:

3.1 India Fair - Melbourne, Australia

March 29 – April 01, 2007

The above fair was organized by India Trade Promotion Organization (ITPO) in Melbourne over an exhibition area of 1500 sq. mtrs. in which around 80 organizations participated. Ministry of Science and Technology and Earth Sciences participated in the fair over an exhibition area of 300 sq. mtrs. DSIR participated in the fair as a constituent of Ministry of Science and Technology. Around 100 visitors visited the DSIR pavilion, with enquiries on: non-ferrous smelting technology, SPV panels and products, manufacturing of vending machines for sanitary products, chapati maker machine, minimization of damage due to earthquakes, herbal beauty products, plastic pipes for telcom cables, water purification, HVAC products, chillers, gas fired boilers, bending of rubber-wood, commercialization of device attached to a golf stick for tracking

movement, commercialization of chewable tablets that will prevent tooth decay and fire safety audits. A seminar was also organized on March 30, 2007 which included a presentation by "Austrade" that promotes the interest of Australian businessmen keen to do business overseas. The "Fair" demonstrated that there is a good potential for alliances between Australian and Indian organizations. Collaborative projects could be undertaken in areas such as IT, bio-technology, electronics, solar photo-voltaics, biodiesel, water conservation, de-salination plants, dairy and coffee processing plants etc. with potential for setting up of joint ventures in some of these areas. Business could be also established in Australia in outsourcing of hi-tech products, machinery and equipment from India.

3.2 INDIATECH 2007 (11th Technology Trade Pavilion) at India International Trade Fair, New Delhi *Nov. 14-27, 2007*

The objective of the Technology Trade Pavilion is to promote display and dissemination of information relating to technological capabilities, high value added products and technologies of companies and organisations including R&D laboratories, academic institutions, product design institutions, consultants etc. The Technology Trade Pavilion 2007 was setup jointly by Department of Scientific and Industrial Research (DSIR) and India Trade Promotion Organisation (ITPO) for the eleventh time in succession since 1997. The space in the Technology Trade Pavilion was offered free (cost shared equally by DSIR & ITPO) to the R&D laboratories / institutions and other small and medium scale enterprises engaged in technology related business. A space of 1000 sqr. mtrs. was reserved in Hall No. 18, Pragati Maidan, New Delhi for the 11th Technology Trade Pavilion.

Around 40 organisations, both from public and private sectors including R&D laboratories participated in the 11th Technology Trade Pavilion. These included Mecpro, SS Foundry, Gabsons Engineers, Dip Craft, Coral Industries, HEG Ltd., NRDC, CEL, CI Network Technologies, Senso Medi Systems etc. The participating organisations in the Pavilion displayed their technological capabilities through models, prototypes, interactive computer based displays, charts, machinery/product samples, etc. Technology Innovation Awards were bagged by M/s. CI Network Technologies, Senso Medi Systems and HEG Ltd. and best display awards were bagged by NRDC, Dip Craft and Gabson Engineers.

The 11th Technology Trade Pavilion helped in promoting one-to-one interactions and business negotiations between the participating organizations displaying their technology intensive products, technologies, machinery, services, etc. and potential customers of Indian technology and services. These interactions, including interaction between R&D organizations and industry, generated many business enquires, besides creating awareness about India's technological capabilities.

3.3 Profiles of Exportable Technologies from SMEs – State-wise

The objective of the project is to compile information on exportable technologies and projects from SMEs and disseminate it through internet, documentation, conferences, etc. with a view to enhance international technology trade. The compilation of profiles of exportable technologies and projects from SMEs in the states of West Bengal & North Eastern States (through WEBCON), Gujarat & Rajasthan (through GITCO), UP, Uttaranchal, Bihar and Jharkhand (through Sycom Consultants) and Madhya Pradesh,

Chattisgarh and Orissa (through MPCON) were completed during the year. A comprehensive web enabled searchable database of profiles, containing 578 profiles was also prepared during the year. This was disseminated to foreign embassies, Indian missions and other international trade bodies. Positive feedback has been received from the embassies and missions and it is expected that this will facilitate technology trade between India and other countries.

3.4 Technology Export Development Organisation

The main objective of the Technology Export Development Organization (TEDO) - a cell jointly setup jointly by DSIR and CII is to promote and support technology and technology intensive exports through collaborative efforts of government, industry, research & academic institutions, financial institutions and other export promotion agencies. In the second phase during 2005-07, TEDO focused on capability building and export promotion of around 40 companies in the process plant and machinery sector and the tooling sectors. Profiles of these companies, highlighting their exportable technologies, projects and hi-tech products were prepared. Unit level assessment of companies in the tooling sector was carried out. TEDO participated in the Hannover Fair, 2006 and Achema Fair in Germany in May, 2006 and Euromould Exhibition in Germany in November, 2006. The TEDO website was re-designed and a virtual exhibition was hosted on the website.

The second phase of the TEDO project (2005-07) was concluded during the year so as to initiate a focused and result oriented project.

The project on Capability Building to Enhance Export Competitiveness & Facilitating Market Access for Indian Technologies and Technology Intensive Products was started during the year. The project shall be implemented by CII and Centre for Promotion of Imports from Developing Countries (CBI), Netherlands with the support of DSIR and Department of Commerce. The project aims at capability building for enhancing the export competitiveness and global market reach of SME's in six identified sectors, viz. Auto Components, Tools & Dies, Casting and Forgings, Process Plant and Machinery, IT Enabled Engineering Services and Agro / Food Processing. The output expected from the project is 30 trained consultants in the chosen sectors and 120 trained SMEs with capability to export to the EU and other markets.

3.5 Centre for International Trade in Technology

The main objectives of the Centre for International Trade in Technology (CITT) in IIFT, New Delhi are: to sensitize policy makers regarding the importance of technology trade and the need for establishing an enabling and proactive policy regime; to support the corporate sector by providing information regarding relevant global commercial opportunities and market potential in priority markets; and to develop a cadre of experts and trainers to provide specialized training to the industry and policy makers. A study on exportable R&D services from the ICMR system was completed during the year. The study highlights the core competencies of all the ICMR laboratories as well as the infrastructural facilities present in them. It describes the contract R&D services and consultancy services that can be provided by the ICMR labs for exports. During the year, three new projects were also sanctioned to CITT. One was a study on technology branding in SMEs and other two were MDPs on "Global Marketing of Technologies" and "Global Sourcing of Technologies".

3.6 Promoting high Technology Co-operation and Trade between India and CIS Countries

The objectives of the project are: to identify specific Indian suppliers of technologies, projects and high tech products; to identify specific collaborating agencies and business partners in the CIS region; and to facilitate one-to-one interaction, signing of MoUs, etc. The target countries are Uzbekistan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Ukraine, Azerbaijan, Russian Federation, Belarus, Armenia, Moldova and Georgia. The project is being funded jointly by DSIR and Department of Commerce under their Focus CIS Programme and MAI scheme. During the year, the consultant (MITCON) identified the parties from the Indian side as well as from the CIS side for signing MoUs on technology related projects. MoUs were signed during the Technology Summit, held in Pragati Maidan, New Delhi on 15th November, 2007.

3.7 International Awareness – cum - Training Programme on Packaging Technologies and Machinery including Quality Assessment Systems for Packaging Materials and Equipment (for Food Processing Sector)

The main objectives of this programme are: to share and exchange information on the packaging technologies and related machinery in the food processing sector, used in various countries; to discuss the various quality assessment systems for packaging materials and equipment; to promote and catalyze the extensive use of these technologies and machinery for mutual benefit; and to evolve collaborative R&D and technology related projects, joint ventures etc. in the area of packaging technology for the food processing sector. The programme, scheduled in February, 2008 would invite international and national participants and pave the way for export of packaging machinery in the food processing sector from India.

3.8 Trans-nationalization of SMEs

Three Studies on trans-nationalization of SMEs in the pharmaceuticals sector, machine tool sector and auto-components sector were sanctioned during the year. The objective of the studies are: to understand the major factors that help or hinder the process of trans-nationalization of SMEs; to suggest specific capability development programmes that would promote trans-nationalization of SMEs; and to define the catalytic role that the government can play to accelerate the process of trans-nationalization of SMEs. The study on pharmaceuticals sector was completed and the studies on the other two sectors were likely to be completed during the year. The studies would discuss the companies that have been able to trans-nationalize as well as come up with a list of SMEs that can possibly trans-nationalize with catalytic support from the government or other sources. The studies would also suggest specific programmes and mechanisms, that need to be organized for the SMEs that would enhance their trans-nationalization potential.

II-E. INTERNATIONAL COOPERATION

1. PREAMBLE

The DSIR maintains effective coordination and co-operation with various international organizations such as UNCTAD, WIPO, UNIDO, UNESCAP, and UNESCO at different levels and in association with other concerned Ministries on various issues related to Technology Development and Technology Transfer. Matters pertaining to the APCTT under UNESCAP are dealt with the cooperation of the Ministry of Commerce & Industry and the Ministry of External Affairs. DSIR also plays an active role in APCTT's functioning, particularly relating to its programmes and policies.

The revised Statutes of the Asian and Pacific Centre for Transfer of Technology, adopted by the Commission at its sixty-first session in May 2005, through its resolution 61/4, stipulates, among other things, that the Centre shall have a Technical Committee consisting of experts from members and associate members of ESCAP and from intergovernmental and non-governmental organizations. Members of the Technical Committee shall be appointed by the Director in consultation with the Executive Secretary of ESCAP. The Technical Committee shall be responsible for advising the formulation of the programme of work and on other technical matters concerning the operations of APCTT and the Centre shall have a Governing Council consisting of a representative designated by the Government of India and no fewer than eight representatives nominated by other members and associate members of ESCAP elected by the Commission. The members and associate members elected by the Commission shall be elected for a period of three years but shall be eligible for re-election.

India being the host country provides an institutional support of US$ 200,000 equivalent in Indian Rupees to the APCTT for meeting both the host facilities and local costs. DSIR has extended a programme support towards APCTT Regional Programme on National Innovation Systems (NIS). Another program support is on the Capacity development of skills for scouting and documentation of green grassroots innovations in Asia and the Pacific. This Grassroots Innovations (GRI) project is a DSIR-APCTT-SRISTI Initiative.

2. ACTIVITIES OF APCTT

In 2007, the Centre endeavored to assist the countries of the region in responding to the challenges of integrating rapidly into the global economy by focusing on technology transfer support services for small and medium scale enterprises (SMEs), promotion of national innovation systems and green grass-roots innovations, and the provision of information, networking and the sharing of experiences relating to technology. Under these thrust areas, the Centre undertook a range of programmes of immediate relevance to the region.

Network for Technology Transfer

A major activity was the establishment of networks of technology transfer intermediaries in the region to promote cross-border business cooperation among SMEs. Under the project "Promotion of the technology transfer network for SMEs in the Asian and Pacific region" funded by the Government of Germany, technology transfer institutions in the region were linked to promote cross-border business cooperation and improve the competitiveness of SMEs.

Two online regional portals www.technology4sme.net and www.business-asia.net were developed for technology transfer and for sharing technology information and delivering business support information with a focus on SMEs. To promote these twin websites, APCTT organized a series of programmes in 2007. Experts from government agencies, intermediary institutions involved in technology transfer, and representatives of SMEs in selected member countries in the Asia and Pacific region participated in these training programmes.

Traditional Medicine and Herbal

In view of the interest and importance of technologies for herbal medicine, APCTT and its member countries had established the Asia-Pacific Traditional Medicine and Herbal Technology Network (APTMNET) to develop and promote industrial/technical cooperation on traditional medicine as well as to disseminate information. In 2007, efforts were made to make the network (see www.apctt-tm.net) which links 14 countries in the region a viable and productive network. The 4th Meeting of the Asia-Pacific Traditional Medicine and Herbal Technology Network was held in Kuala Lumpur, Malaysia on 23 and 24 July 2007 hosted by the Ministry of Health of Malaysia. Representatives from China, Indonesia, the Islamic Republic of Iran, Malaysia, Nepal, Pakistan, the Republic of Korea, Thailand and Viet Nam attended the meeting, which reviewed the status of APTMNET website development in member countries with emphasis on the difficulties faced in content development.

National Innovation Systems

To build capacity among countries of the Asia-Pacific region in the field of managing innovations and to share good practices in national policy formulation for national innovation systems (NIS), the Centre has established an NIS online resource centre.

In 2007, the Centre implemented a project funded by the Government of India to develop capacity in member countries to scout, document and disseminate green grass-roots innovations and traditional knowledge. Activities were organized with the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), an NGO in India that has established the well-known honeybee network, as a knowledge partner. These included a regional workshop to discuss conceptual issues in scouting documentation, database development and dissemination of green grass-roots innovations, a workshop for partner institutions and three national workshops in Indonesia, Philippines and Sri Lanka. During the workshops discussions were held on methodologies to scout and document grassroots innovations so that a foundation could be laid to utilize such innovations to foster social entrepreneurship. It is hoped that based on the outcome of this project, new initiatives could be developed in member countries to facilitate worldwide commercialization of grassroots innovation. An Asia-Pacific Grass-roots Innovation website is envisaged that will present the experience gathered and existing literature on grassroots innovations and traditional knowledge.

Technology Transfer Services

APCTT provides seekers and providers of technologies with a technology trade platform and renders technology exchange and transfer services to promote technology cooperation and trade among organizations and enterprises of the Asian and Pacific region. APCTT receives offers of technology from research institutions, universities and companies, including large-scale companies and

intermediaries, especially for SMEs. APCTT is exploring the feasibility of designing an Asian and Pacific technology search engine with the idea of connecting various technology databases available in the public domain so that potential seekers and sellers can search these through the APCTT website.

APCTT's periodicals continue to play an essential role in the dissemination and promotion of technology information and utilization. Copies of the Centre's periodicals, the Asia Pacific Tech Monitor and the Value Added Technology Information Services (VATIS) in the areas of Ozone Layer Protection, Waste Technology, Biotechnology, Food Processing, and Non-Conventional Energy are distributed in 60 countries. The web versions of the Centre's technology-oriented periodicals are available at www.techmonitor.net.

In 2007, the Centre made concerted efforts to strengthen cooperation with the least developed countries, landlocked developing countries and Pacific island developing countries through the provision of advisory services and organization of programmes of interest and relevance to these countries.

To foster cooperation between its members, ESCAP undertakes a combination of normative, analytical and technical cooperation work to review the socio-economic performance in the region, to identify trends, highlight good practices and foster regional cooperation. In this regard, APCTT has given priority to normative and analytical work and focused on issues such as barriers to technology transfer in SMEs and MSMEs and initiatives needed for their mitigation; impact of technology transfer activities on social development; best practices of the utilization of R&D results by SMEs and the private sector; and a comparative study of technology transfer laws and regulations in the Asian and Pacific region.

APCTT Technical Committee & General Council

The third meeting of the Technical Committee was held on 26 and 27 November 2007 in Bali, Indonesia and was attended by 24 experts from 13 countries namely Bangladesh, China, India, Indonesia, Islamic Republic of Iran, Malaysia, Nepal, Pakistan, Philippines, Republic of Korea, Sri Lanka, Thailand and Viet Nam. The third session of the Governing Council of the Asian and Pacific Centre for Transfer of Technology (APCTT) was held on 28 November 2007 in Bali, Indonesia.

In 2007, the Centre received contributions from China, Indonesia, Iran (Islamic Republic of), Malaysia, the Philippines, the Republic of Korea, Sri Lanka and Thailand in varying amounts ranging from US$ 2,400 to US$ 35,000. During that period, a total US$ 202,199.78 was received from the Government of India for institutional support of the Centre.

3. FOREIGN DEPUTATIONS FROM DSIR

Senior Officers of DSIR were deputed as Resource Persons/Participants to various events as below:

- APCTT. 3rd Meeting of the Technical Committee (TC) and the 3rd Session of the Governing Council (GC), of the Asia and Pacific Centre for Transfer of Technology (APCTT) and two-days' APCTT-LIPI-IBWA Workshop on Women Entrepreneurship Development (WED), during 26-30 November 2007 in Bali, Indonesia

- APCTT. Asia-Pacific Regional Workshop on Grassroots Innovation for Senior Policy-Makers Building Capacity for Scouting, Documentation, Database Development and Dissemination of Grassroots Innovation 04-05 June 2007, Nanjing, China.
- APCTT. Strengthening IT-powered SME-Oriented Technology Transfer Mechanisms: www.technology4sme.net & www.business-asia.net, 4-6 June 2007, Nanjing, China, and 23-25 April 2007. Bangkok.
- Asia Pacific Information Network (APIN), 3rd Meeting, Co-Organized by UNESCO Bangkok & The National Library of Malaysia, 26-28 February2007, Kuala Lumpur, Malaysia
- Board of Administrators of the Demonstration Centre set up by NRDC, 1st Meeting, 17th -18th May 2007, Abidjan, Ivory Coast.INDIA FAIR, Melbourne, Australia, 29 March – 1 April, 2007.
- International Conference of Technology, 16th Meet, Florida, 13-17 May 2007.

II-F. CONSULTANCY PROMOTION PROGRAMME

1. OBJECTIVES

The main objectives of the Programme are to strengthen and promote consultancy services in various areas including:

- Consultancy services for acquisition or import of technologies, requiring technological and managerial competence to evaluate the technologies and engineering them as per local requirements, Promoting quality Foreign Direct Investments (inward and outward).
- Consultancy services for export of projects, technologies and services and setting up Joint Ventures abroad, etc.
- Consultancy services for development and transfer of technologies from R&D institutes and strengthening linkages of R&D system with industry.
- Consultancies for new and emerging areas of national interest.
- Other areas as may be identified including special efforts for consultancies for SMEs and tiny sector.
- Support to Consultancy Development Centre (CDC) and other promotional organizations relating to Consultancy.

2. ACTIVITIES

Some of the programmes/activities carried out during the year, are briefly indicated below:

2.1 Documentation of Consultancy Capabilities and Experiences

Creation and Maintenance of Industry Specific Sectoral National Online Database of Consultants and Consultancy Organizations in India

The project for creation and maintenance of industry specific sectoral national online database of consultants and consultancy organization in India was entrusted to CDC. The data base of about 3500 consultants has been compiled and a portal www.indiaconsultants.gov.in has been developed. The project is in progress.

Development of Model Grading/Rating System for Consultants in India in association with ICRA Ltd.

The study for Development of Model Grading/Rating System for Consultants in India in association with ICRA Ltd. was entrusted to CDC and being implemented in collaboration with ICRA Ltd. The inputs from various consulting organizations in six workshops organized in various parts of the country have been obtained. The draft report is under finalization. The project is in progress.

Study on Consultancy Capabilities in Bio-medical Waste Management in India

The study on Consultancy Capabilities in Bio-medical Waste Management in India by APITCO Ltd., Hyderabad was entrusted to APITCO, Hyderabad. APITCO has submitted revised draft report on the study. The draft report was considered satisfactory and accepted for dissemination in the workshop.

Study to assess the potential for export of consultancy services from India to four African countries viz. South Africa, Mozambique, Ethiopia and Botswana

The study to assess the potential for export of consultancy services from India to four African countries viz. South Africa, Mozambique, Ethiopia and Botswana was entrusted to ICRA Management Consulting Services Ltd. The project is in progress

Study to assess the potential for export of consultancy services from India to four European countries viz. Bulgaria, Romania, Hungary and Czechoslovakia

The study to assess the potential for export of consultancy services from India to four European countries viz**.** Bulgaria, Romania, Hungary and Czechoslovakia was entrusted to ICRA Management Consulting Services Ltd. The project is in progress.

Workshops, Seminars & Training Programmes

DSIR has been supporting workshops & seminars related to consultancy services.
Two Workshops on Consultancy Services – Challenges & Prospects by WEBCON were organised. Ninth Chemical Research Society of India (CRSI) National Symposium in Chemistry by Delhi University was organised. One International Unnayan 2007 by Institute of Electrical and Electronics Engineering (IEEE) at Birla Institute of Technology was organised. Five Technical Meets in India through Consultancy Development Programme (CDP) on Industrial Electronics by FICCI.

2.2 Promotion of Design Engineering Service Centres and Consultancy Clinics

Though India has developed considerable consultancy capabilities in several areas, consultants need to develop design & engineering capabilities in specific industrial sectors, particularly in the context of globalization, and thus become more competitive. These capabilities would also be useful in commercializing and marketing of indigenous technologies. Also, consultants and consultancy services need to be utilized optimally not only by big and medium industries, but by the small-scale industries as well. Keeping these objectives in view DSIR has evolved programmes for promotion of Design & Engineering facilities in specific sectors, such as food processing, textile etc. and Consultancy Clinics in select areas to support SMEs particularly those located in clusters. The following centres/clinics have been supported:

Setting up of Consultancy Clinic for Hosiery Industry

The project for Setting up of Consultancy Clinic for Hosiery Industry at Kanpur by U.P. Industrial Consultants Ltd, Kanpur was supported. The Clinic has established all desired test facilities and equipments to support the needs of the hosiery industries in Kanpur. The Clinic has organized need based training course to assist the hosiery industries. The project is in progress.

Setting up of Consultancy Clinic for Jute & Jute Diversified products

The project for Setting Up of Consultancy Clinic on Jute & Jute Diversified Products by West Bengal Consultancy Organisation Ltd., Kolkata was supported. The adequate facilities in the Clinic have been set up and the Centre has been organizing regular training programmes and technical assistance to jute units has been useful to resolve their technological problems. The project is in progress.

Setting up of Consultancy Clinic on Product Styling & Design

The project for Design & Engineering Centre for Mould Designs Used in Automotive and Durable Consumer Goods with Class A Surfaces by PSG College of Technology, Coimbatore, was supported. The facilities including desired softwares have been installed and industries have started utilizing the design center services. The project is in progress.

Setting up of Consultancy Clinic for IT Sector for SMEs

The project has been entrusted to C-DAC, Noida. The facilities have been installed. The Consultancy Clinic has been in operation including its utilization by SME's units. The project is progressing satisfactorily.

Training programmes on consultancy needs and services in Disaster Management in seven member countries of TCDPAP.

2.3 Institutional Programme Support

DSIR has been providing capital & recurring support to CDC, an autonomous organization of DSIR, to promote and strengthen consultancy capabilities in the country in the domestic & export market.

3. REPORTS/ PUBLICATIONS/ PAPERS

- Technical papers/reports relating to technology & consultancy, including the following were prepared and presented in various technical forums:
- Country paper in International Conference on Engineering & Disaster Management at Lahore, Pakistan, organized by Association of Consulting Engineers, Pakistan, in association with the TCDPAP Secretariat & FIDIC/ASPAC (Asia Pacific Regional Group of the International Federation of Consulting Engineers in March, 2007.
- Report on "Consultancy Export Potential in select countries" viz. USA, UK, Japan, South East Asia and East Africa.

In addition to above, the report on "Guidelines on Procedure for Selection of Consultants, Fee structure for consultancy services and Standard Contract Agreement" was finalized for government approval for seeking approval from Committee of Secretaries.

4. ADVISORY SERVICES

Advisory services were made available to various consultancy related organizations and Departments in relation to their programmes and activities. Participation in some of the Committees and events are listed below:

4.1 Committees

- Governing Council, Executive Committee, Membership Committee, Awards Committee for Excellence in Consultancy, Review & Technical Committees of Tenth National Consultancy Congress of CDC and CDPA committees of CDC.
- Governing Council of to Consultancy Engineers Association of India (CEAI).
- Executive Committee Technical Consultancy Development Programme for Asia and Pacific (TCDPAP).
- Member of the Research Advisory Committee National Council for Cement and Building Materials.

4.2 Seminars/Workshops/ Meetings

- Technical Consultancy Clinic for Jute & Jute Diversified products was organised by WEBCON, Kolkata.
- Two Awareness Programme organised on Hosiery Technology and testing for the hosiery manufacturers at Kanpur were organized.
- Two Workshops on Consultancy Services – Challenges & Prospects by WEBCON were organized.

- International Seminars on Capacity Building and Project Sustainability Management by Consulting Engineers Association of India was organized.
- Ninth Chemical Research Society of India (CRSI) National Symposium in Chemistry by Delhi University was organized.
- International Unnayan 2007 by Institute of Electrical and Electronics Engineering (IEEE) at Birla Institute of Technology was organized.
- Five Technical Meets in India through Consultancy Development Programme (CDP) on Industrial Electronics by FICCI were organized.
- Project Review Committee meetings to review and monitor the progress of ongoing projects/studies were held.

5. Activities Planned till March, 2007

Following activities have been planned for support upto March, 2007.

- Tenth National Consultancy Congress on "Outsourcing: Role of Consultants" organized by CDC from 15-16 January, 2008.
- Five Workshop cum Awareness Building Programme for Growth of SSI & Self Employment by North Eastern Industrial & Technical Consultancy Organisation Limited (NEITCO).

II-G. TECHNOLOGY INFORMATION FACILITATION PROGRAMME

1. PREAMBLE

Technology Information and Facilitation Programme (TIFP) has the broad objective of generating endogenous capacities for the development and utilization of digital information resources to facilitate accelerated S&T research. It endeavors to ensure that Information and Communication Technologies (ICT) are fruitfully used in all the sectors of development and facilitate collaborative research among industries and institutions. The scheme is being implemented as a co-operative and collaborative venture and built around the existing infrastructure, wherever possible. The strategy concentrates in facilitation of Indian content on S&T, avoid duplication of efforts, allow minimum overlapping and maximum utilization of existing facilities.

2. OBJECTIVES

The specific objectives of the programme are designed to:

- Develop appropriate endogenous information capacities to support R&D activities
- Support the production of local content and to promote capturing of indigenous knowledge base
- Promote information and knowledge networking at local, regional and national levels to facilitate flow and sharing of information resources
- Support education, training and R&D in digital content development and utilization
- Promote national and international cooperation in related areas

The critical areas of focus during Eleventh Plan under the programmes would be on content development and delivery of nationally available science and technology information and improving the technical competency of persons involved in information handling and delivery.

3. ACHIEVEMENTS

The specific achievements of the programme during the period of report are:

3.1 Promotion of Content Development

Multimedia database of available Pest Management Technologies of major oilseeds and pulse crops of Central India (Jabalpur)

The objective of the project of Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur is to develop multimedia database of available Pest Management Technologies of major oilseeds and pulse crops of Central India. The software will act as a research and extension tool to provide ready information on available pest management technologies to farmers. The multimedia feature of the software will assist in quick and easy identification of major pests of crops during the growing/off season. It would also help in adopting result oriented and sustainable pest management technologies and in increasing the total crop production of the region and improving the economic status of the farmers. The project has been successfully completed and the details are available at http://jnkvv.nic.in/IPMProject/ ipm-home.html.

Computerized botanical database on wild ornamental plants of Himalayas (Solan)

The project of Dr Y S Parmar University of Horticulture & Forestry, Solan, Himachal Pradesh is aimed at preparing a database on

wild ornamental plants of Himalayas. Important floral/medicinal resources have been documented. The database would also help to assess the national wealth in the form of natural resources by knowing the exact position of plants having economic uses. The project has been successfully completed.

Development of digital image database of Bishnupur terracotta art and sculpture and Traditional design of Potchitra, Baluchori & Madhubani (Kolkata)

Under the project, the CALIBNET Society, Jadavpur University, Kolkata developed a database of available literature and photographic images on Bishnupur terracotta art and sculpture and traditional design of Potchitra, Baluchori & Madhubani and would be hosted on Internet. This database has not only offered a database on Terracotta and Temple architecture but also provided a pictorial view of the present state of this invaluable evidence of our heritage. The project has been successfully completed and the details are available at http://www.bankuraonline.in

Preparation of Database on Metallo-pharmaceuticals (Pune)

The project of CSIR Unit of Research and Development of Information Products (URDIP), Pune focuses on research that bridges the areas of inorganic chemistry and medicine. The user-friendly database would be designed to search via metal name that can provide list of all medical conditions where the metals are used for treatment with the complete metal profile covering details like modern metallo-complex medicines and traditional uses of the metal in the form of bhasmas, various stages in preparation, medicinal properties, dosage, and *in-vitro, in-vivo,* clinical trials and toxicity studies of metals. The project is nearing completion.

Floral potential of J&K State: Survey and Documentation (Srinagar)

The proposal from Department of Library and Information Sciences, The University of Kashmir, Srinagar, J&K aims i) to survey flora of the state having medicinal, aromatic and economic values from both secondary and primary sources, ii) to create digital products/objects embedded with rich information content of indigenous knowledge and linkage for national and international content, iii) to host the database on the server for the use of entrepreneurs, researchers, etc. and iv) to populate data on continual basis from the state. The project is under progress.

Indian Wood Insect Database - a Database on diversity of indigenous and exotic wood insects/pests in India (Bangalore)

The proposal on Indian Wood Insect Database- a Database on diversity of indigenous and exotic wood insects/pests in India from Institute of Wood Science and Technology, Bangalore aims to make an illustrated database of Indian wood insects, tree species wise by collecting information from all available records and insect specimen collections/museums in different institutions of India and add new information by assessing the current status of diversity of wood inhabiting insects in indigenous and exotic trees and their timber and timber products. The project is under progress.

Design and Development of on-line database on Mycorrhiza (New Delhi)

The proposal on Design and Development of on-line database on Mycorrhiza from The Energy Resources Institute, New Delhi aims to design and develop a comprehensive on-line database on mycorrhiza-related literature; enable open access to the database, including abstracts and bibliographies, and open-access full-text research articles; directory of

mycorrhiza scientists in Asian region; and facilitate retrieval of current research findings and development; promote mycorrhiza research among Indian scientists, agriculturists, students and mycorrhizologists. The project is under progress.

Development of Decision Support software System for Cereals, Millets, Pulses and Tuber crops & establishment of an Agricultural Digital Information centre (Trivandrum)

The proposal from College of Agriculture, Vellaveni, Trivandrum aims to develop a Decision Support System for identified Cereals and millets namely Wheat, Maize and Sorghum incorporating relevant aspects like Crop Protection System, Fertilizer Recommendation System, Cultivation practices , Water Management System and Implement Selection with visuals, multimedia and other features; to develop a Decision Support System for Pulses namely Soybean, black gram, green gram, red gram incorporating relevant aspects like Crop Protection System, Fertilizer Recommendation System, Cultivation practices, Water Management System and Implement Selection with visuals, multimedia and other features; to develop a Decision Support System for Tuber crops namely tapioca, sweet potato, colocasia incorporating relevant aspects like Crop Protection System, Fertilizer Recommendation System, Cultivation practices ,Water Management System and Implement Selection with visuals, multimedia and other features; to extend training of the package to agricultural scientists and agricultural extension workers and to give sufficient copy of the software, and launching a downloadable and sample version of the software in the Internet; and to establish a Agricultural Digital Information centre cum Agri-Kiosk. The project is under progress.

3.2 National Websites/ Servers

Science & Technology Portal (Pune)

The portal developed by CSIR Unit of Research and Development of Information Products (URDIP), Pune is a single show case window on Indian Science & Technology. Basically it covers information on public and private S&T infrastructure, expertise and facilities available with these institutions, associated educational, government and private organizations and their activities. The top categories include: Agriculture, Archaeology, Astronomy, Atomic Energy, Aviation & Aeronautics, and Biotechnology etc. Portal provides option for online homepage creation to its users, gives a single point access to information about S&T events, and provides facility of Newsletter subscription. A search engine has been provided which helps user to search desired information based on a keyword. The portal is hosted at http://www.anusandhan.net and is updated regularly with information on all branches of Science & Technology.

Development of a Coastal Hazards Portal (Goa)

Specific subject information portals have become the need of the day, because of the proliferation of a number of website and internet access to many subjects. General public runs into panic when disasters take place. It is essential that they need to be better informed from general knowledge point of view and also how to face the situation in case of eventuality. It is also essential to know where the right information would be available on the aspects of concern and who the responsible authorities are. Cyclones strike the east coast of India very often. Tsunami is another event that has taken place in recent past and costed us many lives and wealth. Both these hazards originate in the seas and it is essential to develop a portal on this aspect to educate the public and have one

point access to the web information. The project of National Institute of Oceanography, Dona Paula, Goa covers both these hazards and a web portal, http://www.coastalhazards.info has been developed. The project has been successfully completed.

Spread of Indigenously Developed Textile Technology Research via Internet (Ahmedabad)

The project of The Textile Association (India), Ahmedabad includes 3 activities - two on http://www.textileinfoonline.com (TIOL) and one on http://www.textileassociationindia.org (TAI). On TIOL, the effort is to put up a new and comprehensive approach to predict with good accuracy the tenacity of cotton yarns from fibre properties. This sophisticated prediction methodology will be given in toto in a user-friendly manner for mill application. The Spinning Technology solutions will be completed, and similar solution systems will be put up for Weaving, Knitting, and Chemical Processing (bleaching, dyeing, and printing, finishing of textiles). On the organizational web site, a bimonthly journal will be made available in an easy-to-retrieve format. The Journal of the Textile Association (JTA) - is a bimonthly devoted to original technical and management papers of direct utility to textile practitioners. The project is nearing completion.

Industrial R&D in India: A Web Portal (Hyderabad)

The project from Administrative Staff College of India (ASCI), Hyderabad aims to create a Web Portal for Industrial R&D in India. The objectives of the project are i) to capture, analyse and disseminate news, views and also statistical information on industrial R&D units in India; ii) to elicit opinions through interviews of the opinion makers on the topic and highlight the issues; iii) to write features analysing the industrial R&D trends, and iv) to disseminate information through online newsletter. A Web Portal, http://www.rndindia.info has been developed. The project is under progress.

Online Directory of Indian Academic & Research Establishments (Bangalore)

The project from National Aerospace Laboratories (NAL), Bangalore aims to develop and provide fast, reliable and free access to a Directory of Academic and R&D set-ups in India especially in the area of Science and Technology. The project is under progress.

Energy Information Support Services for the Indian Industry (Delhi)

The project of The Energy & Resource Institute (TERI), New Delhi aims at providing information support services to Indian industries by disseminating energy information with special focus on energy efficiency in industries. The project is under progress.

Enterprise Performance Improvement through Integrated Management Systems (Delhi)

The project of the Consultancy Development Centre (CDC), New Delhi aims to establish a web portal on Enterprise Performance Improvement through Integrated Management Systems to guide the users and stakeholders to enhance productivity and profitability. The project is under progress.

3.3 Indian Digital Library of Theses and R&D Publications

Design and Development of Database and Web-Portal of Indian Theses in the field of ManufacturingTechnology & Management (Sathyamangalam)

The objectives of the project of Department of Mechanical Engineering, Bannari Amman Institute of Technology, Sathyamangalam,

Tamil Nadu are i) to develop a web-based information platform for improving the quality of higher education in the field of Manufacturing Technology and Management in India, ii) to promote research in various other areas in the fields of Manufacturing Technology and Management by provision of ready access to information, and iii) to review the practices for dissemination of scholarly information, which have developed in the last decade (1995 to 2005). The project is under progress.

3.4 Documentation of Traditional Knowledge and Folk Wisdom

Design and Development of Database on Folk Knowledge (Aurangabad)

The objective of the project of Dr Babasaheb Ambedkar, Marathwada University, Aurangabad is to survey existence of folk knowledge in rural area of Maharashtra and to analyze and consolidate the data thus collected and then to develop a database using CDS/ISIS. This pilot study will cover 12 villages, two from each division of Maharashtra. The villages will be selected on the basis of representing different cultures, traditions, customs, life style and economic development. The bibliographic database is designed and developed to incorporate the data collected with reference to the audio/video tape recoding of talk. The project has been successfully completed.

Documentation of community knowledge, traditional knowledge and oral traditions in 8 districts in the State of Karnataka with special reference to agriculture and rural practices (Manipal)

The objectives of the project of Centre for Rural Studies, Manipal are i) to survey, collect and document community knowledge and traditional knowledge which are very relevant but not widely known, ii) to survey and document oral traditions which have an impact on science and technology, and iii) to study the simplicity and cost effectiveness of these indigenous practices. While documenting the knowledge systems, focus is being given to agrarian, indigenous knowledge, knowledge pertaining to animal husbandry, seed protection, storage, post harvest technologies, other rural practices which are relevant to rural livelihood. The project has been successfully completed.

Studies on Traditional Folk Herbal Veterinary Medicines and Poisonous plants of Rajasthan (Udaipur)

This project of Department of Botany, College of Science, M L Sukhadia University, Udaipur aims i) to develop a database on Ethno veterinary herbal drugs and poisonous plants, ii) to create awareness among tribals and rural people of the state for their conservation, and iii) Preparation of herbarium of all the Ethno veterinary herbal medicines and poisonous plants for future reference and preparation of herbal veterinary pharmocopia. The project has been successfully completed.

Isolation & Documentation of Indigenous Knowledge & Conservation of Traditional Practices in 5 Districts of Tamilnadu (Virudhnagar)

The project of Arulmigu Kalasalingam College of Pharmacy, Krishnankoil, Virudhnagar, Tamilnadu aims to isolate and record the local knowledge systems, including local species, communities, or ecosystems, the quantity and type of products obtained, the management systems employed in Theni, Virudhunagar, Sivagangai, Dindigul and Madurai Districts in Tamilnadu. The project also aims to determine how farmers, foragers, and other local men in these districts conceive of biodiversity, conservation, sustainability and the cultural basis of their views and to provide information to various agencies, and

educational institutions on the indigenous traditional knowledge and oral traditions to promote the application of local knowledge to modem resource management. The project has been successfully completed..

Development of a Portal and Kiosk of Goldsmith's skill towards enhancement of entrepreneurship abilities among unemployed youth (Durgapur)

The proposal from National Institute of Technology, Durgapur aims to develop a Portal and Kiosk of Goldsmith's skill towards enhancement of entrepreneurship abilities among unemployed youth.

The objectives of the project are i) to develop an archive of specialized diminishing rural skills of gold smiths in text, video, audio and animation format, ii) to create a database of cosmetic jewelries for transferring the knowledge of design of such jewelries to unemployed youth, iii) to create a portal for helping the Gold smith Industry, and iv) to train the unemployed youth and engineering students by using the archive and collection of large cosmetic jewelries at local centre as well as in technical Institutes.

A Portal in Bengali and English language will be created by using the archive, database of digitized 3D view of cosmetic jewelries and collection of cosmetic jewelries for global as well as local use. The project is under progress.

Documentation and Preservation of Agricultural Traditional Knowledge by using Modern Electronic Media through Farmer Participatory Approach (Madurai)

The project of Department of Agricultural Extension and Rural Sociology, Tamil Nadu Agricultural University, Madurai aims to identify and document the traditional/ indigenous technical knowledge for agriculture, horticulture, animal husbandry and allied enterprises from different farming situations like wet, garden, dry and coastal eco systems. The study would be conducted by involving farmers through farmer participatory approach rather than through individual household survey. The project is nearing completion.

Folk Wisdom of West Bengal (Kolkata)

The proposal from CALIBNET Society, Kolkata aims to explore oral traditions, folk rituals ad folk wisdom. The special areas of concentration would *inter alia* include Health practices, human and domestic animals, folk medicine and medicinal plants. The project is nearing completion.

Application of ICTs in Agricultural Extension Services Provision and its Impact on the Tribal Farmers of Arunachal Pradesh State of North-East India (Pasighat)

The proposal from College of Horticulture and Forestry, Central Agricultural University, Pasighat aims to assess the agricultural information needs of tribal farmers; to experiment ICTs in agricultural extension services provision to the tribal farmers; and to assess the impact of ICTs in improved agricultural extension services provision to the tribal farmers. The project is under progress.

Development of a Multimedia Database of Traditional Knowledge in Andhra Pradesh (Delhi)

The proposal from Institute of Defence Scientists and Technologists, Delhi aims to provide a Web-enabled multimedia Database of Traditional Knowledge Existing in Andhra Pradesh so that it can be made widely available on Internet. The project is under progress.

3.5 Electronic Publishing of Selected Indian S&T Materials

E-publishing of the Journal of Tropical Agriculture (Thrissur)

The proposal from College of Forestry, Kerala Agricultural University, Thrissur aims to publish electronically its Journal of Tropical Agriculture. The journals is accessible from http://www.jtropag.in

3.6 Virtual Systems

A Virtual information Centre, http://www.vic-ikp.info has been established at ICICI Knowledge Park (ICICIKP), Hyderabad to provide fast and reliable access to information among industry, academia and public research institutions in the area of S &T. The centre is expected to function as a data access and switching centre for facilitating collaborative research and participate in resource building for the purpose. The project has been successfully completed.

3.7 Open Archives Initiative

Establishing MOLTABLE- An Open Access initiative for Molecular Informatics (Pune)

The proposal from National Chemical Laboratory (NCL), Pune aims to establish a web portal entitled MOLTABLE as an open access initiative to facilitate access to molecular data along with computed data. The project is nearing completion.

Development of OAI based Institutional Research Repository Services in India (Bangalore)

The project on Development of OAI-Based Institutional Research Repository Services in India was awarded to National Centre for Science Information (NCSI), Indian Institute of Science, Bangalore. The broad objective of the project is to facilitate improved access, visibility and impact of Indian science research output through establishment of a network of inter-operable, open access digital research repositories and related services in the country. The project aims to (i) provide technical support to R&D organizations and universities in the country to set up their open access institutional research repositories, (ii) establish a national cross-repository search service by aggregating content from distributed OAI-compliant repositories, and (iii) provide solution and support for legacy non-OAI compliant repositories to become OAI compliant. The project is nearing completion.

Developing an Institutional Repository of Science and Technology (Kochi)

The objective of the project of Cochin University of Science and Technology, Kochi is to develop an Institutional Repository in Cochin University of Science & Technology. The collection of this digital repository may include preprints and post prints of researchers of the department, technical reports, theses & dissertations, teaching and learning materials. This can also be utilized for e-publishing of the findings by the faculty and research scholars. The project is under progress.

3.8 Surveys and R&D Studies

Impact of Technology on Quality of Service Deliveries in Technical and Management Libraries in Karnataka (Manipal)

The objective of the study by TA Pai Management Institute, Manipal is to investigate the nature and status of technology aided services and their impact on quality of service deliveries in technical and management libraries in Karnataka. It investigates the impact of technology on quality of services along five dimensions of services quality. The project is successfully completed and report is available at http://www.dsir.gov.in/reports/tifp/tapmi/tapmi_report.pdf.

Web GIS based Digital Atlas of the Sacred Groves of the North East India: Pilot study with Sacred Groves of Arunachal Pradesh (Nirjuli)

The joint project of North-Eastern Regional Institute Science & Technology (NERIST), Department of Forestry, Nirjuli, Itanagar, Arunachal Pradesh and National Chemical Laboratory (NCL), Pune is for the development of information infrastructure and prototype of Web GIS based digital atlas of the sacred groves of North East India with specific reference to over 150 sacred groves of the state of Arunachal Pradesh. The exercise would help in evolving strategies for conservation and protection of these unique heritage ecosystems. When implemented fully, it would strengthen and support the biodiversity conservation programs within North East and elsewhere in the country where similar types of ecosystems exist. The project is nearing completion.

Feasibility Study on the Self-Sustainability of Information Support Facilities in and around Industrial Clusters of SMEs (Hyderabad)

The objective of the project of National Institute of Small Industry Extension Training, Hyderabad is to propose a suitable information support system for SMEs and to prepare a framework for a self-sustaining system in and around SMEs, which can largely meet their information requirements. The project is successfully completed. The findings of the study and recommendations are available at http://www.dsir.gov.in/reports/tifp/study/smeaptn.pdf.

Archiving Ethnomedicinal Knowledge and Local Health Care Systems (LHCS) through Modern Electronic Gadgets: An Explorative Study (Madurai)

The project of Department of Human Development, Home Science College and Research Institute, Tamilnadu Agricultural University, Madurai aims i) to list the existing ethno medicinal practices (medicinal plants) and Local Health Care Systems followed by the remote villagers, tribals and nomads, ii) to enumerate and document the practices with the help of modern electronic gadgets, iii) to explore the scientific rationale behind the documented practices, iv) to assess and compare with the modern scientific technique with the help of public private partnership, and v) to preserve the practices through multimedia based protocol for the benefit of scientific community, industrialists and others. The project is under progress.

3.9 Education and Training

Digital Content Development for Human Resources Development of Rubber Industry (Thane)

The objective of the project of Indian Rubber Manufacturers Research Association (IRMRA), Thane is to develop a video learning course on basic rubber technology to promote human resource development for technologists and supervisors working in rubber industry. The courseware would be particularly useful for upgrading the skills of lower segments of rubber industry technicians and supervisors. The project is successfully completed.

Web based interactive multimedia training programme on Digitization and Digital libraries (Delhi)

IGNOU, New Delhi has been awarded the project to develop a Web based interactive multimedia training programme on Digitization and Digital libraries. The focus of the project is i) to provide facilities for learning the process of digitization, developing digital libraries and knowledge

repositories using open source software like Greenstone Digital Library, Dspace ii) to facilitate self learning through multimedia courseware, and iii) to stimulate learning through online interaction with experts and peer groups. The project is under progress.

Workshop on Building Digital Libraries using Dspace (Delhi)

A workshop on Building Digital Libararies using Dspace was organized by The Energy and Resource Institute (TERI), New Delhi during April 10-13, 2007 at TERI, New Delhi. DSIR supported and participated in the workshop. The details of the workshop are available at http://www.teriin.org/events_inside.php?id=17896.

Advanced Workshop on Greenstone Digital Library Software: Multilingual capability and Interoperability (Bangalore)

An Advanced Workshop on Greenstone Digital Library Software: Multilingual capability and Interoperability was organized by National Centre for Science Information, Indian Institute of Sciences, Bangalore. DSIR supported the event.

3.10 Expert Meets/Seminars/Conferences

Three events namely**,** Info Vision 2007, Future of Knowledge Organization in the Network Environment, and Digital Preservation of Heritage and Research Issues in Archiving and Retrieval were partially supported.

Sensitization-cum-Awareness Programme for Technology Information Facilitation Programme

The Sensitization-cum-Awareness Programme (SAP) for Technology Information Facilitation Programme (TIFP) was organized by TIFP-DSIR in collaboration with local organizing agencies at Allahabad, Cochin, Gulbarga, Guwahati, Indore, Nagpur and Sathyamangalam. The objective of SAP for TIFP was to identify the requirements of the industry in connection with the implementation of the TIFP, prioritize them and to formulate specific projects for the cause of promotion and development of information use and access to the users clientele.

II-H. INFORMATION TECHNOLOGY AND e-GOVERNANCE

1. IT-ACTION PLAN

The Department has taken up e-Governance activities in line with the Government directions during Tenth Plan and a comprehensive IT-Action Plan has been formulated as under:

- ⇨ *Infrastructure Development:* Provide and maintain Personal Computers (PCs) and other essential IT- equipment and software to all the functionaries.
- ⇨ *Networking:* Establish and maintain the Local Area Network (LAN).
- ⇨ *Office Automation:* Implement various applications that not only maintain records of receipt, issue of letters and movement of files but also offer enhancement in accountability, responsiveness and transparency in governance.
- ⇨ *IT Training:* Provide relevant training courses to the officers/ staff that enable them to work on computers by using application software developed.
- ⇨ *e-Reports*: Convert the Acts, Rules, Circulars and other published materials of interest or relevance to the public, in the electronic form.
- ⇨ *Website*: Enrich the contents of the DSIR website by including downloadable forms and guidelines relevant to various citizen services that Department provides.

2. ACHIEVEMENTS

Meetings of IT Committee were organized regularly to seek guidance/ approval on procurement of IT related hardware and development of application software. Various client server applications remained operational while a few more were under development. The client server application systems that remained in use/ developed/ being developed are the following

2.1 Client Server Applications which Remained Operational

- **'INTRADSIR'**- remains as an effective messaging client, intend virtually to eliminate, flow of paper based intra-office/inter-office memos and similar documents. The built-in features of this INTRADSIR include functionalities such as bulletin board service, employees information and e-leave submission, thought for the day and it also acts as a secured access site to all other applications.
- Document Management Information System (**DMIS**) –accessible through INTRADSIR, as a centralised repository of all the documents and remains as a system for diarising and file movement.
- Central Information System (**CINFOSYS**) - provide the historical or time series data on various aspects of Grant-in-aid Scheme of the Department.
- Department remained equipped with a Public Grievance Redress & Monitoring System (**PGRAMS**). The system was designed and developed by National Informatics Centre (NIC) as per guidelines of Department of Administrative Reforms and Public Grievances (DAR & PG). Being a WEB based system, it is centralized and remain available to the public as **CPGRAMS** which within the Department, it is accessible through INTRADSIR/ EXTRADSIR

- Procurement and Inventory Management system '**PIMS**' to maintain the inventory status of general stationary items, consumables of computers, etc remained functional and used for proper utilization of such items.
- Foreign Collaboration Approvals Information Management System (**FCAIMS**) remains online/ offline as an application software for mining information in a user friendly way from the database of all the approvals of foreign collaborations approved by the Secretariat of Industrial Assistance, Ministry of Commerce and Industry and Reserve Bank of India over the last 15 years.

2.2 Client Server Applications that were Developed during the Year

Project Application and Monitoring System 'PAMS'

A project for customization of an Integrated Project Application and Monitoring System "PAMS" has been taken up and now in data input stage. This system was customized for projects receipt for support and under various components of TPDU scheme. PAMS application being a menu-driven and Graphical User Interface based software, it enables the application users to navigate through different menus and windows to capture data and process the transactions.

Enhanced Features at the INTRADSIR:

Instant Messaging facility consists of facility for attaching files and sending the same to other employees. As an added feature, this instant messaging service has a pop up facility. Any message sent to other users appears on the screen when the user gets logged in INTRADSIR, Any new message which is unread pop up on the screen.

Employee Detail Module deletion or updating control has been provided to the administration section of DSIR for ensuring the maintenance of updated employee details.

VPN account Operation and EXTRADSIR

Information and the data flows between DSIR and the bodies under its control namely CSIR,CDC,NRDC and CEL remains through an EXTRADSIR application system that has been made over a VPN account operated at NIC. EXTRADSIR application acts as a medium for any instant flow of information between Technology Bhawan and those other geographically separated DSIR offices. The system has following main features

- Users send and receive, secured instant messages (to and from DSIR) through INBOX and OUTBOX.
- Users also access over its homepage, Department's Circulars and News, the available Document Management Information System for effective file transactions and also accessing Centralized Public Grievance Redress & Monitoring System

IT-Security Policy and its frame work for DSIR

The security policy as laid down is being ensured through in-built access security in the system itself. The VLANs provide segmentation services over the routers in LAN configurations. Therefore a VLAN over a logically segmented switched network for DSIR was planned and the required switches were procured. This VLAN is being created at Technology Bhavan with the help of NIC. In addition to switches, the necessary hardware comprises of a Rack and two Rack mount servers were also procured

and installed which are in operation at Technology Bhavan. A three level Security Architecture has already been adopted that includes authentication, use of cryptography /Encryption and allowing access to IP-restricted services.

2.3 On-Going IT-eG Activities

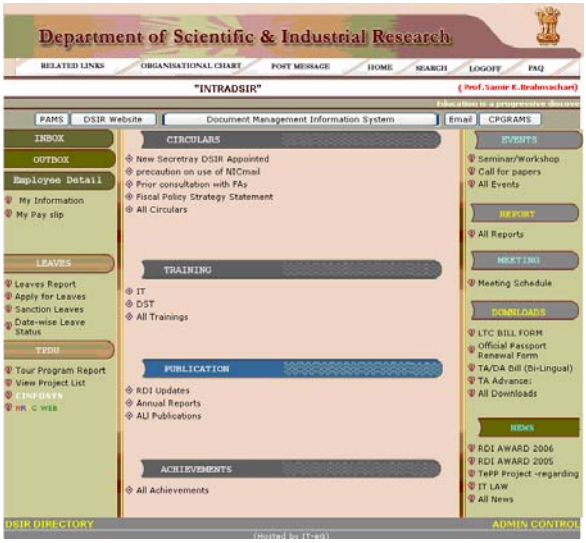
DSIR Website updations

DSIR website http://www.dsir.gov.in is continuously being updated. The Department website is continuously updated. The main components of the site include: What's New; About US including Administrative, Organizational and Functional Structure, Telephone and Email Directory; Annual Report; Citizen Charter; Ministers; TPDU Programme; Download Forms; Publications; Technical Reports including Executive Summaries of 162 Technical Status Reports; Forthcoming Events; Links to Parliament Q&As; Search

Useful URLs; Advertisements; Tenders; Vacancy; Directories; Autonomous Bodies (CSIR and CDC); Public Enterprises (NRDC and CEL). The website also has a search facility and an email link to send feeback / comments/ suggestions. A separate section on Right to Information has been provided as the Website for proactive disclosures under the Right to Information Act, 2005 enacted on June 15, 2005.

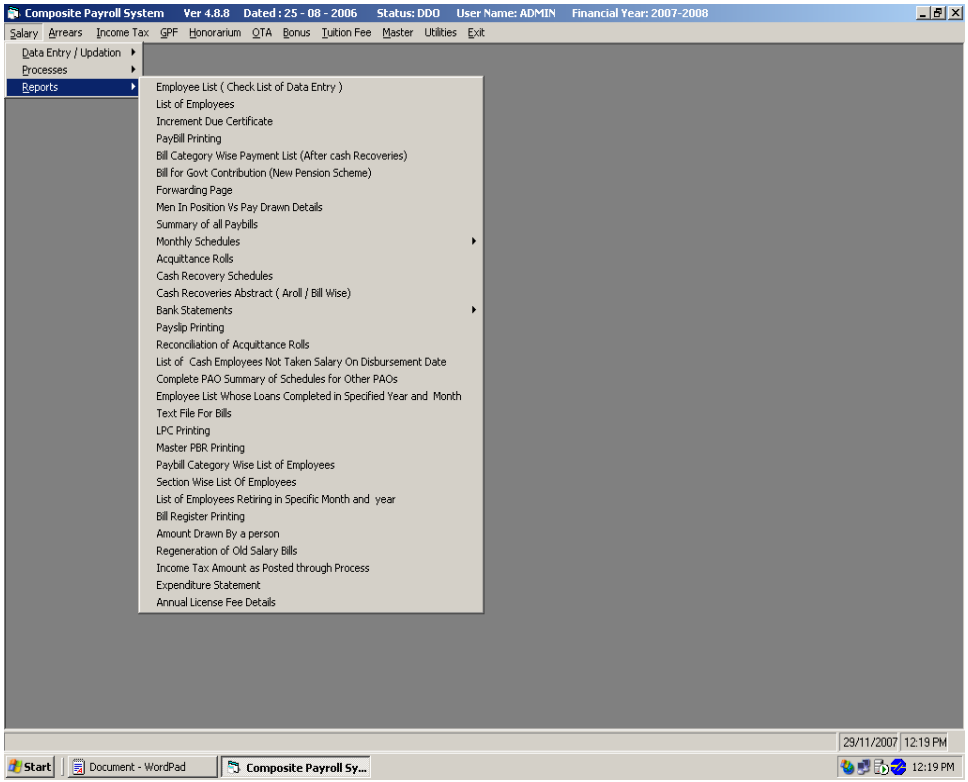
Composite Pay Roll System

A Customized Pay Roll System has been developed by NIC The system currently remains under validation stage and soon would be replacing the existing earlier developed stand alone FOXPRO based data management system.



INTRADSIR for internal entities

EXTRADSIR for other offices of DSIR



Composite Pay Roll System
Developed by NIC customized for DSIR

II-I. TECHNOLOGY DEVELOPMENT AND UTILIZATION PROGRAMME FOR WOMEN

1. PREAMBLE

The Gender Cell has been set up as per the guidelines/ circulars issued by the Ministry of Finance for promoting gender budgeting and steps have been taken to enhance the share of women in respect of beneficiary oriented schemes and launched a Technology Development and Utilization Programme for Women (TDUPW). The programme is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. The objectives of the programme are:

- Promoting the adoption of new technologies by women
- Awareness creation and training of women in various technologies
- Technological up-gradation of tiny, small and medium enterprises run by women entrepreneurs
- Showcasing of appropriate technologies and organizing demonstration programmes for the benefit of women

2. ACTIVITIES

Some of the projects taken up under the programme during the year are listed below:

Impact of the information and Communication Technology on Women Employment in Kerala

The proposal of the Centre for Development Studies, Trivandrum aims to study the Impact of Information and Communication Technology on employment of women in Kerala. The study is with respect to micro enterprises managed by poor women groups called Kudumbasree. The study would also examine the factors conducive to capacity building in these enterprises in terms of training, management, financial accounting etc. to make them competent to meet customers demand.

An Action Research on Diffusion of Farm Technologies to Farm Women through User-friendly Interactive Multimedia Compact Disc

The proposal of the Department of Agrl. Extension and Rural Sociology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai, is to study and document the technical know-how required by women farmers in different ecosystems through participatory approach, and to develop a user friendly Interactive Multi-media Compact Disc (IMCD) on identified agricultural technologies.

Economic Development of Women SHG member of Talala Taluka in Junagarh District

The proposal from Saurashtra Economic Development Centre, Junagarh intends to provide technical and entrepreneurial development training to 300 members of the women SHGs to take up income generating activities. Training on Electrical, Electronics equipment repairing and Aribharat Embroidery machine technology will be imparted. The duration of the project is one year.

Technological Sustainability of Women Entreprises under Kudumbasree Programme of Kerala

The project of Centre for Tropical Studies, Trivandrum, is aimed at assessing the sustainability of technologies used by the

Kudumbasree micro enterprises and their knowledge of and accessibility to related modem technologies in selected districts of Kerala. The duration of the project is 15 months.

Status of Women Entrepreneurship in Andhra Pradesh

The project by the National Institute of Small Industry Extension Training (NISIET), Yousufguda, Hyderabad aims at studying the demographic profiles, motivational factors, behavioral competencies and problems of women entrepreneurs in Andhra Pradesh and to suggest a policy framework for promoting women entrepreneurship in the state. The duration of the project is 12 months.

Rural Women and Technology in Karnataka: A comparative Study of Selected Districts in South and North Karnataka

The project of Mahatma Gandhi Memorial College, Udupi, Karnataka aims to identify linkages between women's roles, responsibilities and use of technology by rual women, to explore the ways in which women use their knowledge and skills to develop, modify and adapt the techniques and technical processes in which they are involved, to examine the links between indigenous and modem technologies in relation to gender considerations and to find out whether locally available indigenous technologies are appropriate to the living conditions of rural women etc. The project can contribute to a greater understanding of the linkages between women's roles, responsibilities and their use of technology. The duration of the project is 2 years.

Technology Adoption and Utilization Programme for Women in Handicraft Sector (TAP HAND)

The implementation of this proposal from Kerala Rural Development Agency (KRDA), Kollam, Kerala would facilitate the adoption in Coir Technology, dye making among 1000 women craftsmen in Screwpine Craft in Kerala and shall build up capacity and awareness of the craftsmen engaged in the above said handicrafts activity. The duration of the project is 12 months.

Upgrading indigenous technology for preparation of herbal products as home remedies and food supplements by encouraging sustainable cultivation, conservation and propagation of medicinal plants involving rural women of West Bengal

The project of Ramakrishna Mission Ashram, West Bengal aims to survey and document a) herbal wealth b) related available indigenous knowledge and c) prevalence of human disease of the targeted localities; Development of suitable technology using principle of organic farming for cultivation, propagation, conservation of some for the locally available as well as newly introduced medicinal plants for use in prevention and cure of human diseases; upgrading the existing technology for preparation of compost, vermicompost and plant based biopesticides and encouraging the targeted women to adopt those for achieving the organic farming and encouraging cooperative farming and entrepreneurship basing on plant women partnership for marketing the herbal raw material/ products for additional income generation.

Propagation of Technologies & Development of Micro Enterprises by Women in Andhra Pradesh, Orissa & Kerala States

The project of APITCO Limited, Hyderabad, relates to conduct a pilot study to identify technologies available with different CSIR labs and other institutions and viable investment opportunities for setting up of

Micro & Small Enterprises among the women entrepreneurs.

Training –cum-Workshop on Development of Modern Educational Training Kits for Women Consultancy Cells

Under the project, the Electronic Research Development & Facilities (ERDC), Ambala, Cantt, would provide 6 months training in a practical oriented workshop to 120 women science graduates/ diploma or +2 Science, so that they are fully trained to take up the tasks related to modern educational training kits used in polytechnics, Science & Engineering Colleges and Research institutions.

Farm and Non-Farm Sector Employment and Tribal Women- A Socio Economic Analysis

The project of the Directorate of Research, Dr. Y. S. Parmar University of Horticulture and Forestry, Solan (HP) aims to study the gender wise employment status and pattern in Farm and non – farm sectors.

Training of Women in Computer Aided Drafting Package and Microsoft Office Software

The project of Bannari Amman Institute of Tehcnology, Sathyamangalam, Tamilnadu is to train women to increase their participation in technical jobs.

Empowering Women through Entrepreneurship Development

The project of the MITCON is for empowering the potential of women entrepreneurs through scientifically designed training programmes in 3 districts of Maharashtra. The vocational courses would be conducted in the areas of food processing, bakery, gem and jewellery and herbal cosmetics. The duration of the project is 2 years.

Identification of Gaps in Technology Utilization and Training for the Development of Rural Women - A Study in Andhra Pradesh

The proposal from the Council for Social Development, Hyderabad is to identify the industries in which women can easily adopt improved technologies, assess the existing gap in the present state of technology and prepare a training module and conduct training programmes for the benefit of rural women.

Propagation of technologies on water conservation and waste disposal through women group

The Proposal submitted by Rajagiri Out REACH Service Society, Kochi, Kerala aims at training women on waste management, rain water harvesting and propagation of biogas and rain harvesting technology to women.

Technology transfer for fruit and vegetables processing for women groups for small entrepreneurship development in the villages of border area of Uttranchal hills

The proposal received from Society for Environment & Employment Development (SEED), Uttarkashi, Uttaranchal aims at organizing village women of border area of Uttaranchal in groups for transfer of technology for fruit and vegetable processing packaging of product and marketing and small entrepreneurship development for income and employment generation.

Impact of globalization and adoption of new technology on silk industry in Assam: An assessment from gender perspective

The proposal received from IIT Kharagpur, aims at studying the impact of globalisation and adoption of new technology on silk industry in Assam. It also proposes to assess the level of technology, wage structure, pattern of income, training, healthcare and

other facilities with special reference to women before and after elimination of textile quota restrictions. The research aims to identify the factors crucial for the adoption of technology, and development of women entrepreneurs in the state.

Training program for metropolitan unemployed women to establish their own consultancy cells for food processing and quality control

The main objectives of the proposal received from Mustard Research and Promotion Consortium (MRPC), New Delhi are to create a large pool of trained women workforce with experience in analyzing food quality, to encourage women participation in food processing industries and to help women in building up of a professional network, so that, they can setup their own food processing and quality analysis consultancy cells.

Primary processing and value addition of sweet potato and yams for self employment generation by women

The main objectives of the proposal received from Central Tuber Crops Research Institute (ICAR), Thiruvananthapuram is focused research on three aspects, ultimately leading to the perfecting of technologies that can benefit women to start small agri-business ventures. Two of the unexploited root crops viz., sweet potato and yams have been included in the study, considering the large scale global awareness and utilization of the crops for product development for combating malnutrition and vitamin-A deficiency. The positive attributes of sweet potato like high carotene, calcium etc., and those of yams like high density dietary fibre will be exploited to develop products that can capture the health conscious Indian markets.

Sensitization / Awareness Programmes of Technology Development and Utilisation Programme for Women (TDUPW)

DSIR has organized six one day Sensitization / Awareness Programmes of Technology Development and Utilisation Programme for Women (TDUPW) in coordination with various Institutes/ Universities/NGOs, in different regions of the country, during 2007-2008. It is hoped that the Sensitization Programme would enable the participants in taking advantage of all the schemes and programmes of both the Central and State Governments, financial institutions and other agencies and we shall go ahead to build a new India with gender equality and productive women power

Women Entrepreneur - Ramacham Products - Malappuram

Training of women for construction of mobile biogas plant under the project "Propagation of technologies on water conservation and waste disposed through women group".

II. TECHNOLOGY PROMOTION, DEVELOPMENT AND UTILIZATION PROGRAMME

1. INTRODUCTION

The Technology Promotion, Development and Utilization (TPDU) Programmes is directed towards meeting the specific needs of industry and is of particular relevance in the present context. Programmes and activities under the scheme are centered around promoting industrial R&D, development and commercialization of technologies, acquisition, management and export of technologies, promotion of consultancy capabilities, etc.

2. OBJECTIVES

The broad objectives of TPDU Programme are:

- Promote and support industry efforts towards R&D
- Encourage cooperation between R&D system and industries
- Support industry for technology development, demonstration and absorption of imported technology
- Build indigenous capabilities for development and commercialization of contemporary products and processes of high impact
- Evaluate the status and performance of technology in selected sectors / areas.
- Facilitate effective transfer and management of technology
- Promote international technology trade including export of technology projects,
- services and technology intensive products
- Promote and strengthen consultancy capabilities for domestic use and export requirements. Support and use mechanisms, both national and international, towards transfer of technology, both within and outside the country
- Generate endogenous capacities for the development and utilization of digital information resources for providing inputs to scientific & industrial research in the country

3. IMPLEMENTATION

The objectives are implemented through the following component programmes:

- Industrial R&D Promotion Programme
- Technology Development and Innovation Programme
- Technology Management Programme
- International Technology Transfer Programme
- Consultancy Promotion Programme
- Technology Information Facilitation Programme
- Technology Development & Utilization Programme for Women
- Information Technology and e-Governance

III. AUTONOMOUS BODIES

III-A. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

1. INTRODUCTION

During the Tenth Five Year Plan (TFYP), CSIR experimented a model in which resources available with various laboratories were pooled together to achieve technological excellence. CSIR conceptualized and implemented 56 such network projects during Tenth Plan. Being the terminal year of TFYP, majority of the network projects have been completed successfully however some projects are permitted to spill over for a year or two into the Eleventh Five Year Plan for their completion.

Research on the fundamental or basic aspects of science is not only the major source of advancement of knowledge in science but it also provides the building blocks for development of newer generic technologies for the future. CSIR continuously upgrades its core competencies and plans new research areas to lead the S&T developments primarily within the country and occasionally abroad. Its area of influence encompasses aerospace science & technology, modern biology and biotechnology, chemistry, geophysics, oceanography, materials science, etc.

CSIR is not only the flag bearer of India's S&T processes but contributes significantly in developing research manpower through inducting thousands of young students to carryout their research programmes in its laboratories. Many of its scientists have continued to contribute in shaping India's S&T policy initiatives in diverse science domains.

The following sections record some of the significant achievements of CSIR during the year. Many achievements have resulted from the projects carried out under 'network' mode which essentially means a group of three or more synergistically linked laboratories working on one single R&D projects having shared or common objective or outcome.

2. S&T CONTRIBUTIONS

2.1 AEROSPACE SCIENCE & TECHNOLOGY

CSIR is a major player in India's aerospace programmes. Its constituent laboratory, NAL, Bangalore has developed a world class capacity for design, development and fabrication of large components of advanced composites for civilian and combat aircraft, structural testing and analysis, aerospace electronics and systems, innovative capabilities in surface engineering etc. The activities are focused on design, development, fabrication and airworthiness, testing of small civilian aircraft and on creating, maintaining and providing expertise and test and certification facilities.

Scientific & Technological achievements

Flight Testing of SARAS Aircraft

The first SARAS prototype aircraft (PT1) VT-XSD completed 56 test flights during the year (total 106 successful test flights so far). Basic handling qualities, Pressure Error Correction (PEC) test data, Parameter Identification Data (PID) test data, climb performance data etc., have been obtained and evaluated.

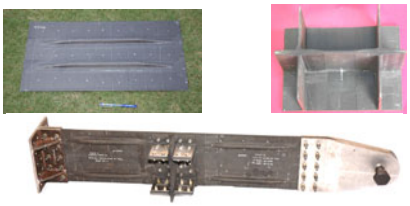
100th flight of SARAS(PTI)

The second SARAS prototype aircraft (PT2) VT-XRM has been fully integrated and has successfully completed low speed and high speed taxi trials. 100th flight of SARAS (PT1) at the AeroIndia 2007

Vacuum Enhanced Resin Infusion Technology

NAL has developed a Vacuum Enhanced Resin Infusion Technology (VERITy) process for advanced composites manufacturing. An aircraft wing using this new process would result in a weight saving of about 10% on the optimized metallic wing with a cost reduction of about 20%. Some of the advantages of the VERITy process are: relatively low cost for low volume production (significant reduction in cost when compared to autoclave-moulding cost), eliminates the need for clean rooms and expensive cold storage facilities (-18^{o}C).

A Test box (2.3mx1.2m) has been designed to prove the VERITy process and testing the skin and spar splices with closely simulated conditions as well as to verify the adequacy of the sealing mechanism for the inter spar box joints (integral fuel tank area) and access covers. Some of the components made out of VERITy process are displayed below.



Skin Splice Parts and Assembly

Rapid resin injection moulding technology

Another novel and cost effective technology developed by NAL is for the rapid resin injection moulding process. Flight-worthy nose radomes for Jaguar fighter aircraft have been designed, developed and fabricated by NAL for Hindustan Aeronautics Ltd. (HAL) / Indian Air Force (IAF) incorporating the above technology. These radomes are further qualified to the stringent military specifications and have been cleared as flightworthy. This has given an insight into the intricacies of composite radome engineering and has created base for indigenizing the requirements of IAF for other fighter aircrafts. This competence is being used to propose development of an indigenous radome for SU 30 fighter aircraft.

Nose Radome for Jaguar Aircraft

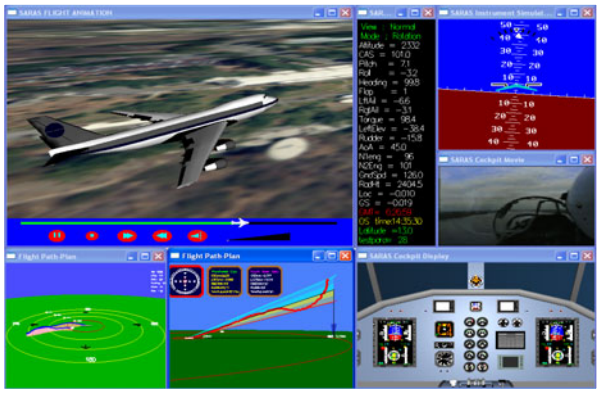
Ceramic thermal barrier linings

For providing ceramic thermal barrier lining for strategic applications on axi-symmetric metal components NAL has developed a novel technique using exothermic reactions under the effect of centrifugal force. This process makes the material immune to corrosion and erosion. The lining helps the material to withstand high temperatures of the order of 3000K. Another spin-off of the technique is the zirconia based ceramic insert, which has been developed for rocket thrusters. This near-net shaped casting has good thermal shock resistance & high temperature hardness. This technology is of a great strategic value for rocket and missile applications.

Thermal barrier lining to steel pipe

NAL Visualization and Animation Software (NALVAS) software

Another notable achievement from NAL is a software for incident and accident analysis of aircrafts along with the routine flight data analysis, which is a mandatory activity as per Director General of Civil Aviation for every scheduled airline. The tool unfolds the actual behavior of aircraft during flight in terms of events, exceedances and limits visually instead of numbers and figures. The use of this software greatly enhances the air safety and mandatory quality assurance requirements. NALVAS is a configurable windows concept which can be configured the way user would like to see the windows during operation.



NALVAS showing the capability for aircraft models with ILS operation

Progress made under Network projects

Some of the significant achievements detailed project-wise are:

I. Catering to specialised aerospace materials

The objective of the project is to formulate and execute a structured programme on development and characterization of different specialized aerospace materials and to provide materials related technological services to aerospace organizations.

Convergent-Divergent nozzles used in strategic application have been lined with ceramics capable of withstanding temperature of 1600 to 1800°C. The nozzles have been tested in the Defence R&D Laboratory (DRDL) test bed and the performance of the coated nozzles was excellent. The nozzle did not show any damage even after 22 seconds of firing (against a target of 20 sec) and there was no significant pressure loss for the entire duration of the firing. Pressure sensitive paints for measurement of the air pressure distribution over models during wind tunnel testing developed by NAL have successfully withstood endurance of over 50 blowdowns without any change in their sensitivity.

Billets of Mg-Al-Zn (AZ31) and Mg-Re-Zn-Zr (L126) alloys with size of 70mm dia and 50 mm height were fabricated using spray forming technique. These billets have shown excellent compositional uniformity, low porosity and good mechanical properties.

A major development is the establishment of a state-of the-art failure analysis laboratory which facilitates failure investigations for IAF, Aerospace industries and Defence R&D labs. It has helped in providing critical data on failure investigations and courts of enquiry. Incidentally NAL has completed the

1000th failure investigation during the current year.

II. High science & technology for national aerospace programmes

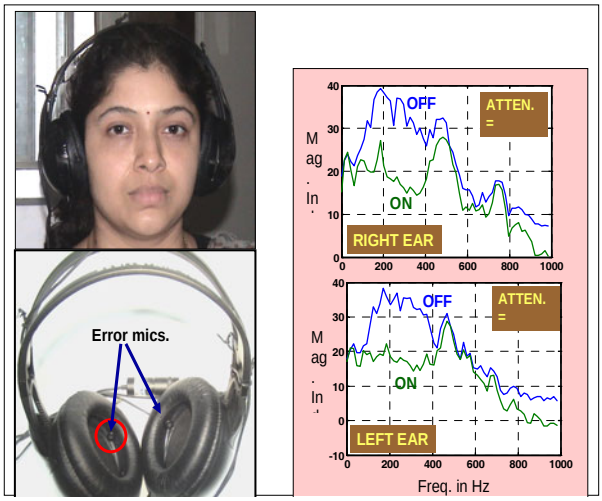
The main objectives of this programme are to enhance the capabilities for generating crucial design and certification data for aerospace systems; to enhance the knowledge base through R&D activity for increased self-reliance and freedom; and build up new and critical facilities in the area to minimize dependence on foreign test facilities.

Aerodynamics: Aerodynamic data has been generated on hypersonic research vehicle / its components. The most significant achievement is development of hardware for study of multi jet interaction on after-body drag. The readiness for tethered flight of Remote Controlled (RC) Blimp at Aerial Delivery Research and Development Establishment , Agra has been tested.

Aerospace propulsion and energy Systems: Detailed component drawings/manufacture of components and critical design review for Wankel engine has been carried out. components have been designed and fabricated for 10 kW gas turbine. A national Test Facility for Rolling Element Bearings is being setup.

Aerospace structures and materials: Sources have been located for manufacture of components for autoclaves and related accessories for demonstration of adaptive wing technology. A customised un-balanced magnetron sputtering system has been commissioned. Hard nano layer coatings were done on sample cutting tools.

***Aerospace electronics, controls and systems*:** Active Noise Control (ANC) for *Tejas* combat aircraft cockpit has been developed. The *Tejas* aircraft cockpit and the helicopter cabins have serious problem of high noise levels. It affects health of the pilot and also causes inconvenience in communication. Algorithms, used for the active noise control, play a very crucial role reducing the noise level in the active noise control systems used. NAL has designed and developed hardware and software (algorithms) for addressing this problem and noise reduction of 15 dB has been successfully achieved in the head phones of pilots. This work is being attempted to a full aircraft and active noise control is being attempted for the fighter aircraft cockpits and helicopter cabins.



Head set with active adaptive noise control for broadband noise

III. Spearheading small civilian aircraft design, development & manufacture

The main objectives of the project are to design and develop stretched HANSA; civil aircraft R&D; indigenous development of critical Line Replaceable Units (LRUs) with particular relevance to small aircraft; and weight optimization and other improvements of SARAS to production standards.

An MoU has been signed with M/s Mahindra Plexion Technologies, Bangalore for joint development of 4-seater HANSA aircraft.

Also a contract has been signed with M/s. Honeywell Technologies, Bangalore for the joint development of digital autopilot for the SARAS aircraft.

The design review for nose and main landing gears for the production version of SARAS have been carried out. A number of components were manufactured for the landing gear actuators.

Parts manufactured for the landing gear actuators

The first phase of optimization of nacelle, stub wing and engine mount has resulted in a weight reduction of around 30kg

Three engines (PT6A-67A) with a power rating of 1200 SHP at 1700 RPM have been procured from M/s. Pratt and Whitney, Canada. In addition, four pusher propellers rated at 1200 SHP at 1700 RPM were procured from M/s. MT Propeller, Germany. The 120 hrs of endurance tests for this Propeller-Engine combination, for certification as per JAR-33 regulations, were completed successfully in an engine ground test bed located at NAL. A flow computational programme for a transport aircraft in flight has been jointly worked out by NAL and the Cambridge University.

Head set with active adaptive noise control for broadband noise

2.2 Biology & Biotechnology

CSIR has emerged as a leading public funded R&D agency with many of its laboratories contributing significant R&D outputs and technologies in the areas of genomics, proteomics, molecular biology, immunology, bio markers, bio molecules etc. Some of the major accomplishments are provided below.

Scientific & Technological Achievements

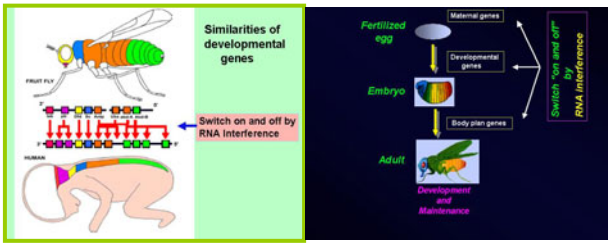
Engineering of host-defense antibacterial peptides as therapeutic agents

CCMB has investigated the antibacterial activities of synthetic human β-defensin analogs, constrained by a single disulfide bridge and in the reduced form. The peptides span the carboxy-terminal region of human β-defensins HBD-1-3, which have a majority of cationic residues present in the native defensins. The disulfide constrained peptides exhibited activity against *Escherichia coli* and *Staphylococcus aureus,* whereas the reduced forms were active only against *Escherichia coli.* The antibacterial activities were attenuated in the presence of increasing concentrations of NaCl and divalent cations such as Ca^{2+} and Mg^{2+}. The site of action was the bacterial membrane. A 13-residue peptide present in mammalian neutrophils, which has both antibacterial and hemolytic activities, has been engineered so that only antibacterial activity is exhibited by the modified peptides.. Since this research has important impact in the development of antibacterial peptides as therapeutic agents, a US patent has been secured.

Role of RNAi for animal development

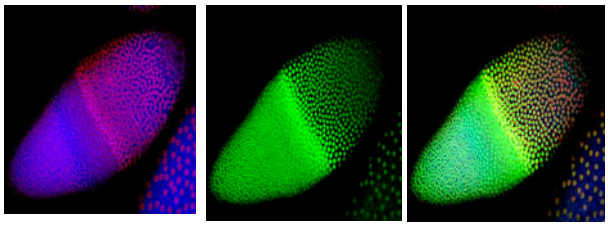
CCMB & IICT has, jointly, unraveled the molecular mechanism associated with developmental abnormality in *Drosophila*, which is required for dynamic chromosome

movement. This abnormality causes various birth defects and most common cancer including brain tumor and other fatal neuro-degenerative diseases. The normal function of several genes eliminates irreparable abnormalities. A genetically well-developed model system- fruit fly- was compared to understand the fundamental relationship of different developmental and segmentation genes which are conserved in all animals including mice, flies and human. It has been demonstrated that RNAi-based silencing machinery is required for establishment and maintenance of silencing state of different segmentation genes and developmental regulators. It is proposed that RNAi plays an immense and novel role in guiding complex animal formation during development and eliminate several fatal diseases in embryo. Further results show that preferential switch "on and off" of different developmental genes is controlled by RNAi machinery. In future, this might help to repair different birth defects by controlling the RNAi machinery. It paves a new beginning for generating different types of RNAi-based therapies for birth defects.



Genomic packaging and nuclear architecture

Eukaryotic genomes carry complex set of regulatory elements that control the genes to allow developing and functioning of such organisms. A key feature of this regulatory process is that packaging of the genome itself has influence on expression of genes. CCMB has characterized components of nuclear matrix at molecular level. Among the proteins of the nuclear matrix a protein has been identified, known as boundary- element-associated factor (BEAF) earlier known to be the component of chromatin domain boundary. One of the major unsolved problems in this field is how genome is repackaged after every cell cycle in such a way that global expression state is maintained and how cells remember the epigenetic state in absence of early developmental regulators? It has been shown that BEAF remains associated with the genome even after the nuclear envelop has disintegrated. Further it has been shown that BEAF remained associated with various mitotic components suggesting a link between genomic packaging and nuclear architecture that can serve as structural platform for epigenetic memory. It is known that loss of such memory can lead to variety of disease situations, including cancer.



Early Drosophila embryo stained for genome packaging protein, BEAF (green), DNA (blue) and nuclear envelop component, lamin (red). The embryo shows mitotic wave going from left to right showing that in the regions where lamin has disappeared, BEAF still remains associated with the genome. Left picture shows DNA and lamin, middle one shows BEAF and the right one shows a merged image of embryo

Unprecedented $SnCl_2$-mediated cyclization of Nitro Arenes via N-N bond formation

CDRI has developed a mild, efficient, and one-pot protocol for the intramolecular cyclization of nitro arene substrates using $SnCl_2$. The mechanistic course suggests involvement of a hydroxylamine intermediate for cyclization via N-N bond formation. The

versatility of the methodology has been demonstrated by using two nitro arene substrates derived from dihydroisoquinolines and dihydro-beta-carbolines. The intramolecular cyclization led to the formation of indazoles in high yields and purity. The methodology may find wide application in synthesis of heterocyclic compounds using a suitable molecular framework.

CLIV-92, the hepatoprotective phytoceutical

CIMAP has tested CLIV-92 a hepatoprotective molecule, for its effect on the pro and anti-inflammatory cytokines. Pro-inflammatory mediators (IL-6, TNF-α and nitric oxide) were significantly inhibited in dose dependent manner when compared with macrophages stimulated with LPS alone ($P<0.05$). Whereas, the anti-inflammatory cytokine (IL-4) productions from spleenic lymphocytes culture supernatant were found to be enhanced in mice administered with CLIV-92 when compared with Con-A alone ($P< 0.05$). These results suggest that CLIV-92 can augment the protection of liver stressed by the intake of chemotherapeutic agents by inhibiting the expression of pro-inflammatory cytokinines.

CIM–Sujal: high yielding variety of fennel

CIMAP has developed the cultivar CIM-Sujal of fennel *Foeniculum vulgare* through intensive breeding efforts for high yield of seeds and essential oil of better quality. Fennel family '*Apiaceae*' is important for its seeds and essential oil. Seeds are used to flavour liquors, vinegars, breads, pastries, candies and pickles. Leaves and stems serve as vegetable, salad or potherb. Essential oil is used in culinary articles, cordials and toilet articles. Besides above, it is also used in Indian, Ffolk and Unani systems of medicine as abortifacient, carminative, cardio tonic, stimulant, vermicide, lactagogue, etc. The seeds are also regarded as aromatic, carminative, emmenagogue, and stimulant and stomachic almost anywhere the spices are encountered. Variety CIM–Sujal consistently shows high seed and oil yield in all field evaluation yield trials. The average seed and oil yield of this variety is about 9.73 quintal and 22.87 kg/ hectare respectively with high t-anethole content (75-80 %) and low fenclione content (8.08 %), respectively. The variety will find direct utility in herbal preparations and nutraceuticals in addition to its spice value and also as a source of anethole for industrial cultivation.

Aloe vera based all-purpose cream

An effective all purpose skin care cream formulation named H Aloe Skin developed and released by CIMAP. The cream possesses wound healing and anti fungal properties and can also be used to cure cracks in heels, chapped hands and dry skin. It is a herbal formulation, derived from age-old traditional skin recipe from a plant extract that is known for its healing activity and an essential oil, which has shown a promising anti fungal activity. The cream is pharmaceutically more elegant because it contains water washable cream base in order to give a smooth and soft feeling on application. The technology is available to industry for its commercial exploitation.

Effect of altitude on primary products of photosynthesis

IHBT has reported for the first time a change in primary products of photosynthesis and the associated enzymes with change in altitudes that could have functional advantages at high altitude (HA). There is not much information available on the primary products of photosynthesis and the change in the activity of the associated enzymes with altitude.

Varieties of barley and wheat grown at 1300m (low altitude, LA) and 4200m (HA) elevations above mean sea level in the western Himalayas were studied. Plants at both the locations had similar photosynthetic rates, leaf water potential and the chlorophyll fluorescence kinetics. The short-term radio-labelling experiments in leaves showed appearance of $^{14}CO_2$ in phosphoglyceric acid and sugar phosphates in plants at both the LA and HA, suggesting a major role of ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) in CO_2 fixation in the plants at two altitudes, whereas the appearance of labelled carbon in *aspartate (Asp)* and *glutamate* (Glu) at HA suggested a role of *phosphoenolpyruvate carboxylase* (PEPCase) in photosynthesis metabolism. Plants at HA had significantly higher activities of PEPCase, carboxylase and oxygenase activity of Rubisco, *aspartate aminotransferase* (AspAT), and *glutamine synthetase* (GS). However, the activities of *malate dehydrogenase*, NAD-malic enzyme and citrate synthase were similar at the two locations. Such an altered metabolism at HA suggested that PEPCase probably captured CO_2 directly from the atmosphere and/or that generated metabolically e.g. from photorespiration at HA.

New cultivar of Curcuma aromatica (HIMHALDI)

Yet another development of significance for hilly regions is the development of a new cultivar of *Curcuma aromatica* "HIMHALDI" by IHBT suitable for cultivation in western Himalaya at locations above 1300m altitude. The rhizome is light yellow (internally orange red) in colour and possesses a camphoraceous odour. *C. aromatica* is some times used as substitute of turmeric but not as a condiment. *Curcuma aromatica* has vast ethnobotanical value, already known in India as tonic, carminative, antidote to snake bite, astringent and used for bruises, corns and sprains. HIMHALDI is raised by planting rhizomes. Plant is distributed in the Himalaya at 1000-2500 m altitude. On an average 200 kg oil/ha is produced from 60 ton raw material (fresh rhizomes) after two years. Total cost of production/ ha (for two years) is Rs.70,000 – 1,00,000 / ha. Net returns per ha (after two years) are in the range of Rs.35,000 – 45,000/ ha. Benefit cost ratio (BCR) is 1.39.

Popularization of Alstroemeria

Alstroemeria (*Alstroemeria hybrida*) is an exotic high value cut flower crop. IHBT has standardized agrotechniques including nutrition requirement, plant spacing, time of planting, method of propagation, method of planting, impact of shoot thinning, irrigation etc. for flower production for Himachal Pradesh and other hill states. Agrotechnologies for cut flower as well as planting material production have been transferred to growers through training and demonstration plots. Three demonstration plots were set up, each at Kangra and Kullu district and IHBT. Growers are earning good returns by sale of alstroemeria flowers in domestic flower markets.

LeishMan topoisomerase I - an unusual enzyme

The active site tyrosine residue of all monomeric type IB topoisomerases resides in the C-terminal domain of the enzyme.

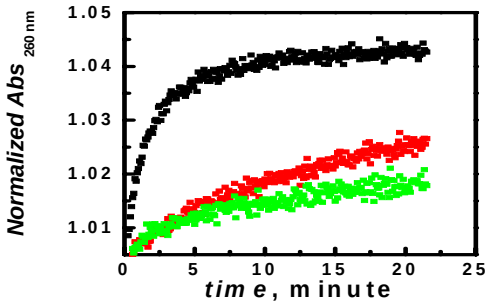
Leishmania donovani, possesses unusual heterodimeric type IB topoisomerase. The small subunit harbors the catalytic tyrosine within the SKXXY motif. To explore the functional relationship between the two subunits, IICB has replaced the small subunit of *L. donovani* topoisomerase I with a C-terminal fragment of human topoisomerase I (HTOP14). The purified LdTOP1L (large subunit of *L.donovani* topoisomerase I) and HTOP14 were able to reconstitute topoisomerase I activity when mixed in vitro. This unusual enzyme, 'LeishMan' topoisomerase I (Leish for Leishmania and Man for human) exhibits less efficiency in DNA binding and strand passage compared with LdTOP1L/S. Fusion of LdTOP1L with HTOP14 yielded a more efficient enzyme with greater affinity for DNA and faster strand passage ability. Both the chimeric enzymes are less sensitive to camptothecin than LdTOP1L/S. Restoration of topoisomerase I activity by LdTOP1L and HTOP14 suggests that the small subunit of *L. donovani* topoisomerase I is primarily required for supplying the catalytic tyrosine. Moreover, changes in the enzyme properties due to substitution of LdTOP1S with HTOP14 indicate that the small subunit contributes to subunit interaction and catalytic efficiency of the enzyme. Engineering of a hybrid 'LeishMan' topoisomerase I, from Leishmania and human is an ideal chimera for drug development.

Interaction between IL1B gene promoter polymorphisms

It has been speculated that IL-1 genes play a crucial role in the genetic predisposition to duodenal ulcer upon *H. pylori* infection by modulating the host immune response. IICB has studied 310 individuals from Eastern India to determine the IL1B and IL1RN risk genotypes to *H. pylori* mediated duodenal ulcer. An analysis of genotype frequency revealed a significantly higher frequency of genotypes in *H. pylori*-infected individuals with duodenal ulcer compared to infected individuals with normal mucosa. Quantitative analysis of the mucosal IL1B mRNA revealed that among *H. pylori*-infected individuals, carriers of the -31CC genotype had significantly lower IL1B transcript levels than carriers of the CT ($P<0.001$) and TT ($P<0.001$) genotypes, independently of disease status. The results also show that *H. pylori*-infected individuals with the -31CC genotype secrete less IL1B and are susceptible to duodenal ulcers. It has been further suggested that the allelic interaction between the -511 and -31 polymorphic sites determines the overall strength of the IL1B promoter.

Water soluble nanoparticles from PEG-based cationic hyper branched polymer

The research involving RNA molecules faces a practical limitation, since RNA is highly labile. IGIB has developed a novel method to protect RNA from cleavage by complexing it with a hyper branched cationic polymer. The property of total cellular RNA isolated from yeast to form a spherical nano particle morphology was used. This interaction protects the RNA against enzymatic degradation, and hence can be easily adapted for long-term storage of RNA, long distance transfer of RNA, and genetic engineering using RNA as a building block.



RNase digestion assays for native RNA (black), HP/RNA complexes at Z+/- 3 (red) and 5 (green).

Genome-wide prediction of G4 DNA as regulatory motifs: Role in Escherichia coli global regulation

IGIB has established the role of DNA structure in transcription on a genome-wide scale using the *G-quadruplex* (G4 DNA) motifs as a model. Analysis of more than 61,000 open reading frames(ORFs) across 18 prokaryotes have shown the enrichment of G4 motifs in regulatory regions and indicates its predominance within promoters of genes pertaining to transcription, secondary metabolite biosynthesis, and signal transduction. Therefore, it has been predicted that G4 DNA may present regulatory signals, and induce the super coiling sensitivity for >30 operons in *E. coli*, implicating G4 DNA in DNA-topology-mediated global gene regulation in E. coli.

Recombinant human epidermal growth factor: from bench to bedside

A renaissance in the study of biology of wound-care by IGIB has led to the development of a range of advanced genetically tailored therapeutic products like growth factors. The epidermal growth factor, produced by salivary glands, enhances healing of diabetic foot ulcer, which is a major complication of diabetes. People with diabetes show a 5 to 50 fold higher risk of non-traumatic amputation compared with non diabetics. In general, diabetic foot ulcers are difficult to heal, become readily infected & gangrenous and frequently lead to amputation. Through a public-private partnership between IGIB, Delhi and BBIL, Hyderabad, two important formulations have been commercialized: one as a brand name Regen-D^{TM} -60 for skin graft and burn injuries, while the other, Regen-D^{TM} -150, for diabetic foot ulcer.

New variety of withania somnifera

A new variety of *Withania somnifera* designated as NMITLI 002 which is both genetically and chemically stable has been developed by IIIM. The root and leaf biomass produced by this high yielding variety is 8-10q/ha and 16-17q/ha, respectively. From multilocational trials at two varied locations that is Jammu and Bhopal, it has been established that this variety can adapt to varied environmental conditions and is stable in terms of both root yield as well as *withaferin A* content. Chemical consistency of the genetically pure lines developed from this variety has been established on the basis of ten bioactive markers. Pharmacological activities (Immunomodulatory and anticancer) of roots and leaves of this variety indicate high promises of yield.

Leaf and root of new variety of Withania somnifera

Piperine, a phytochemical potentiator of ciprofloxacin against staphylococcus aureus

In a trial conducted at IIIM, piperine which was earlier reported, as *P-glycoprotein* inhibitor has been found to act as bacterial efflux pump inhibitor also. Piperine, when used in combination with ciprofloxacin, increases the activity of the drug by reducing

its Minimum Inhibitory Concentration (MIC). This combination also decreases the frequency of mutation thereby decreasing the mutation prevention concentration. The inhibition of accumulation and efflux of ethidium bromide by piperine in the ciprofloxacin resistant mutant confirms its role as inhibitor of bacterial efflux. Several analogues have been prepared. One of the molecules thus developed is 4 times as potent as piperine and is inhibiting several bacterial efflux pumps. It is a significant step towards the development of combination therapy of anti infectives to prevent the emergence of resistance.

Rapid plant regeneration of chlorophytum arundinaceum baker - an endangered medicinal herb

An efficient *in-vitro* multiplication system via multiple shoot bud induction and regeneration in *Chlorophytum arundinaceum* using shoot crown explants has been developed at IIIM. Optimum regeneration frequency (87%) and desirable organogenetic response in the form of de novo organized multiple shoot buds without an intervening callus phase was obtained on MS minimal organics medium. Axenic secondary explants with multiple shoot buds on subculturing elicited best response with 1 x 10^{-5} M Kn and 5 x 10^{-6} M IBA giving rise to an average of 18.74 shoots per culture with mean shoot length of 7.6 cm±1.73. Varying molar ratios of either Kn/IBA or Kn/NAA revealed statistically significant differences in regeneration frequencies among the phytohormone treatments. It has been observed that shoot bud differentiation and regeneration was influenced by molar ratios of cytokinin / auxin rather than their relative concentrations. Genetic fidelity was assessed using Randomly Amplified Polymorphic DNA (RAPD), karyotype analysis and meiotic behaviour of *in-vitro* and *in-vivo* plants. Five arbitrary decamers displayed same banding profile within all the micropropagated plants and in vivo explant donor. The cytological and molecular analysis complemented and compared well and showed no genomic alterations in the plants regenerated through shoot bud differentiation. High multiplication frequency, molecular, cytological and phenotypic stability ensures the efficacy of the protocol developed for the production and conservation of this important endangered medicinal herb.

Multiple shoot bud induction and regeneration in Chlorophytum arundinaceum

Extension of carvomint in South India

A new improved alternative potential source of l-carvone rich strain (carvone 65-73%) CARVOMINT (*Mentha longifolia L.*) *Hudson var. incana*, developed by IIIM has been extended to the farmer's fields in South India. The genetic stability and consistency of the essential oil production and desired quality of this strain has been proved over a period of three years while the high adaptive value, faster regeneration and early maturation 100-110 (DAP) are added attributes of Carvomint. Under north Indian conditions, the yield patterns / economic returns of this new strain are quite promising with 40-45 tonnes of fresh herbage/ha and 160-170 kg of essential oil/ha. This strain also exhibits a significant increase of essential oil production (37%) over spearmint (*Mentha spicata*) which is a known commercial source of l-carvone. Technology package and guidelines for cultivation,

essential oil extraction and market potential has been provided to M/s South Indian Mint & Aromatic Products, Tirunelveli (Tamil Nadu). Approximately 10,000 kg planting material has been supplied to the party to cover 20ha of land in Tamil Nadu during the year. The crop has performed well in terms of essential oil production and its quality characteristics.

Anant Carvone mint growing in fields

Staphylokinase – potent clot dissolving agent

Staphylokinase (SAK), a clot-dissolving agent, has potential clinical application as a thrombolytic agent for the treatment of mycocardial infarction and ischemic strokes. Its ability to display profibrinolytic activity in a fibrin selective manner is beneficial for thromobolytic therapy. As an extracellular bacterial protein, it is produced by several strains of *Staphylococcus aureus*. In its native host, SAK is produced in very small amount along with other toxic proteins; therefore, highly purified preparation of SAK from its native host is difficult to obtain for clinical use. A recombinant system for high level production of this clot-dissolving agent was developed by IMTECH where staphylokinase encoding gene was genetically engineered to overproduce SAK as a soluble cytoplasmic protein in E. coli. The technology for high yield production of SAK has been developed to produce this thrombolytic agent in grams quantities at fed-batch fermentation. Two-step chromatography was standardized to obtain highly purified preparation of recombinant staphylokinase displaying specific activity for plasminogen activation. Using this technology, large amount of this thrombolytic agent can be obtained in pure form that may be useful for clinical application for thrombolytic therapy.

Alternative pathway of glutathione degradation in Saccharomyces cerevisiae

Gluathione biosynthesis and metabolism proceeds through the γ-glutamyl cycle. The degradation of glutathione is usually initiated by the action of γ-glutamyl transpeptidase. IMTECH has provided a genetic evidence for the existence of an alternative pathway for GSH degradation independent of γ-GT. This was demonstrated through the use of cells disrupted in the ECM38 gene encoding the γ-GT enzyme. *S. cerevisiae* encodes a single enzyme for γ-GT. These cells retained the ability to utilize glutathione as a sulphur source demonstrating that an alternate pathway for GSH degradation exists in yeast cells. Using a genetic approach, participants in this novel pathway for the degradation of GSH have been identified. This pathway requires the participation of 3 previously uncharacterized genes in *S. cerevisiae* viz. DUG1 (YFR044c), DUG2 (YBR281c) and DUG3 (YNL191w). Although dipeptides and tripeptides with a normal peptide bond such as cys-gly or glu-cys-gly required the presence of only a functional DUG1 gene that encoded a protein belonging to the M20A metallohydrolase family, the presence of an unusual peptide bond such as in the dipeptide, γ-glu-cys, or in GSH, requires the participation of the DUG2 and DUG3 gene products as well. The Dug1p, Dug2p and Dug3p proteins were found to form a degradosomal complex, through Dug1p-Dug2p and Dug2p-Dug3p interactions. A model has been proposed for the functioning of the Dug1p/Dug2p/Dug3p proteins as a specific GSH degradosomal complex.

Macrophage cell surface Glyceraldehyde-3-phosphate dehydrogenase: A Novel Transferrin Receptor

Glyceraldehyde-3-phosphate dehydrogenase (GAPDH) is known primarily as a cytosolic protein. IMTECH has demonstrated for the very first time that GAPDH has a novel cell surface localization in mammalian cells. The studies reveal the presence of an entirely new uptake mechanism for the iron transport protein transferrin into mammalian macrophages, wherein these cells utilize the ubiquitous moonlighting protein GAPDH as a receptor. This mechanism provides an elegant method by which this abundant cellular protein is relocated to the membrane for this additional role. It has been proposed that mammalian cell surface GAPDH represents a primitive mechanism for the uptake of iron transport proteins that has been conserved in cells. Since GAPDH is a ubiquitous protein, the broader implications of this finding are that in addition to macrophages, this may be an alternative mechanism for iron acquisition in other mammalian cells and tissues. The discovery identifies a new type of ubiquitously expressed Transferrin receptor that bears no homology to the two previously known receptors. It has also been established that this receptor is regulated by the levels of extracellular iron.

Collection and compilation of small antigenic molecules

Infectious diseases, tuberculosis in particular, remain the leading cause of human mortality. IMTECH has developed a database for hapten (small molecules) and anti-hapten antibodies. The database would be of great help in identifying functional group(s) in smaller molecules using antibodies as well as for the development of immunodiagnostics / therapeutics by providing data and procedures available so far for the generation of specific or cross reactive antibodies.

Novel rhizosphere competent high temperature/drought tolerant bacteria

A novel rhizosphere competent high temperature/drought tolerant *Pseudomonas putida* strain, MTCC 5279, which has avery good potential for commercialization due to its ability to survive at high temperature has been isolated at NBRI. This strain will be used to identify and isolate high temperature/drought tolerant gene(s).

Functional genomics of Withania somnifera for gene discovery and drug development

Scientists from NBRI have cloned and sequenced seven full-length genes from *Withania somnifera* gene family of sterol glucosyltransferase. One of the genes from the family has been cloned and expressed in *E. coli*. Isoenzymes of SGT were purified from membrane and cytosolic fractions of *Withania somnifera* leaves. Characterization of these enzymes reveals their role in various biotic, abiotic stresses and withanolide production.

Post harvest biotechnology for prolonged shelf life of fruit, flower and vegetables

Several genes from banana, mango, rose and gladiolus have been cloned and characterized by NBRI, which are thought to be responsible for ripening and softening in fruits and abscission and senescence in flowers. Some of the important genes identified as candidates for future biotechnological uses to improve shelf life of fruits and vegetables are: genes for ethylene biosynthesis, ACC oxidase and ACC synthase; MaMADS, a homologue of tomato MADSRIN, an important developmental regulator of ripening in tomato; eIF1A, a translational initiation factor; a SIN3 like transcriptional co-

repressor and expansins and pectate lyase that are known to participate in fruit softening. AP2/ERF domain transcription factors that are differentially regulated during ripening and abiotic stresses have been isolated and characterized. An increment of almost ten days in the shelf life of transgenic tomato carrying an antisense gene of ACC oxidase from banana has been confirmed with second generation of the transgenic tomato variety. Same construct has been introduced in banana in order to achieve transgenic banana with higher shelf life.

Phytoremediation of metal contaminated environment

Plants of *Bacopa monnieri, Ceratophyllum demersum* and *Hydrilla verticillata* could be useful for phytoremediation of metals and metalloids (arsenic, cadmium and lead) from polluted aquatic bodies as significant accumulation of metals and metalloid was observed in both the plant species without any significant effect on their growth. NBRI scientists have characterized and cloned the gene, *Phytochelatin synthase* gene responsible for the synthesis of phytochelatins from *C. demersum. Vetiveria zizanioides* (khus khus) and lemongrass (*Citronella flexuosus*) were found effective in removing metals thereby improving the physico-chemical properties of the contaminated soil. *Sida acuta*, *Cassis fistula*, *Spinacea oleracea* and *Chenopodium album* were found suitable for the decontamination of most of the metals from tannery waste contaminated sites. Vegetables like, spinach (*Spinacea oleracea*) and Bathua (*Chenopodium album*) grown on tannery waste contaminated soil are, however, unfit for edible purpose due to accumulation of toxic metals above prescribed levels.

Synergistic Bioinoculant Composition

A synergistic bioinoculant composition comprising bacterial strains of accession Nos.- NRRL B-30486, NRRL B-30487, and NRRL B-30488 has been developed at NBRI which is useful as individual and also in several possible combinations with each of the strains showing plant growth promotery and phytopathogenic fungi controlling activity, abiotic stress conditions tolerating and phosphate solubilization capabilities under abiotic stress conditions. Further, a method of producing said composition and isolating said bacterial strains from cow '*Sahiwal'* has also been developed. This being the first report of the isolation of plant growth promoting bacteria from milk, a USA patent (7,097,830 B2) has been obtained for this work.

Improved strain of Lemon grass BLI-Arun through hybridization

A new clone of lemon grass developed at NEIST records very good herb yield (ca 35 to 39 t/ha) and 0.8 to 1.12% essential oil on Fresh Weight Basis (FWB). The major constituents of the oil were geraniol (30.5 to 30.8%), citronellol (24.1 to 24.3%), Geranial (13.0 to 13.6%) and neral (10.1 to 10.3%). Lemon grass (*cymbopogon*) is an important genus of aromatic grasses with about 120 species yielding varied combination of terpenes and non-terpenic phenolic compounds. Lemongrass oil is used in perfumery, cosmetic and pharmaceutical industries and India happens to be the major producer and exporter of lemon grass oil. However, has declined considerably due to low production and competition from other countries. The reason for low production of Lemon grass oil in India was due to non-availability of strain with high biomass yield, oil and citral content.

New and superior source of cimnnamomum

Cinnamomum verum and *C. cassia* are used as sources of Cinnamon spice. NEIST has

identified *Cinnamomum pauciforum*, an indigenous species of Meghalaya having qualities superior to the former. The essential oil/content of leaves varied from 3.5 to 4.0%. Twenty five components representing 98.8% of the total oil were identified. The main constituent is Cinnamaldehyde (89.85%). The composition of the oil is different from essential oils of existing Cinnamon sources by the presence of 3 components (one aldyde & two diterpene), constituting only 0.3% of the total oil.

Progress made under Network projects

Network mode of working, wherein several groups of scientists across various CSIR laboratories, working on commonly identified research problems has gained acceptance and admiration of scientists, leading to mutually beneficially synergistic linkages.

Some of the significant achievements, project-wise, are:

I Exploration and exploitation of microbial wealth of India for novel compounds and biotransformation process

The project envisages to exploit microbial diversity of the country using both culture dependent and culture independent methods, with ultimate goal of its commercial exploitation as a major source of biotechnological products and processes.

(a) Culture dependent approach

Some leads obtained earlier have been actively pursued. Nearly 1200 bacterial isolates have been collected from different ecological niches of the Western Ghats. An armory of well characterized biocatalysts (like *lipases/esterases, oxidoreductasaes, monooxygenases, hydantoinases and glycosidases*) which are adapted to work at variety of pH and temperature has been prepared. These are useful biotransformation solutions to pharmaceutical, agrochemical and fine chemical industry.

Further, twelve new taxa including two new genera and twelve species from different regions of India have been discovered and published.

In addition, two microbial consortia developed earlier for biofertilizer (phosphate solubilisation, dessication resistance and nitrogen fixation) have been exchanged between two labs for testing under field conditions in two different parts of the country. Another microbial consortium was developed for wastewater and poultry waste treatment and tested at pilot scale level.

(b) Culture independent approach

In order to exploit the gene pool of uncultured bacteria, 25 metagenomic libraries of different environmental samples were made. Two libraries have been screened using both function based and sequence based methods for unique esterases and resistance to salt and arsenic. Few unique genes are being investigated now.

II Molecular biology of selected pathogens for developing drug targets

The project envisages in-depth study of molecular biology of a few pathogens for developing drug targets, namely for *Mycobacterium tuberculosis, Plasmodium, falciparum, Leishmania Donovani, Fungal pathogens* (*C. albicans* and *A. fumigatus*), *Enteric pathogens* (*V. cholerae, S. dysenteriae* and *H. pylori*).

Mycobacterium tuberculosis: *Polypeptide deformylase, nucleoside diphosphate kinase A, peptidyl tRNA hydrola*se, enhanced intracellular survival proteins from *M. tuberculosis* were cloned, over expressed,

purified and their biological activity confirmed. Crystal structure of the adenylation domain of NAD dependent DNA ligase were used for designing inhibitors of the enzyme. Further, robust DNA microarray and proteome analysis protocols were developed.

Plasmodium falciparum: Enzymatic properties of Choline kinase, a putative drug target have been elucidated and a screening assay developed. Three proteins coded by apicoplast genome were identified during the year.

Leishmania donovani: Mitochondrial tRNA binding protein, actin binding proteins were cloned, over expressed, purified and their biological activity confirmed. Some natural products (dihydrobetulinic acid, luteolin, diospyrin and indolyl quinolines) were identified as inhibitors of leishmanial topoisomerases.

III Developing cell & tissue engineering

The project targets to develop methodologies for growing cells and tissues (of animal origin) *in-vitro* and induce them to perform differentiated functions; to develop biomedical devices as substitutes for a defective organ or its parts; to develop methodologies for the transplantation of cells and tissues grown *in-vitro* into hosts including humans; and *in-vitro* production of pancreatic β-Cells for transplantation in type I diabetic patients.

Plants: Candidate vaccine protein has been produced in the tobacco plant for immunization against rabies.

Animals: A new culture system for growth of limbal cells has been developed from the human eye.

IV Toxicogenomics of polymorphism in Indian population to industrial chemicals for development of biomarkers

The project aims to understand the molecular basis of the toxic response, identify the biomarkers for toxic exposure, and screen the individuals in the population that are genetically predisposed for differential toxic response. It will help to design suitable strategies for reducing the risk of the chemicals, mitigation and treatment of the toxic response, and adoption of preventive methods for the susceptible individuals.

Polymorphism in the DNA repair enzyme ERCC2 codon 751 is associated with arsenic-induced pre-malignant skin lesions. Specific polymorphisms of gene p53 associated with keratosis in individuals were exposed to arsenic through drinking water. Single Nucleotide Polymorphisms (SNPs) in the gene for epoxide hydrolase showed significant polymorphism (>5%) in Exons 3, 4, 6 and 8. Most notably, a significant association of polymorphism was observed in facor of lung cancer development. 2D-gel electrophoresis of the blood plasma samples from control and lead exposed rats revealed the proteins that are differentially present in lead-exposed animals. Thus, levels of three proteins, identified as different forms of J-chain of immunoglobulins decreased after lead treatment. Another protein, identified as 'alpha-chain of Haptoglobin', was found to increase by 2 folds in lead-exposed animals.

V Designing animals and plants as bio-reactors for proteins & other products

The project envisages designing of transgenic plant, animal, and yeast bioreactors, to develop genetic transformation technology in novel hyper expression systems, to exploit cells as bioreactors for production of high value biopharmaceuticals and to construct

Gtases library for biotransformation (glucosylation) of natural products.

Human AAT gene and Cecropin gene from *Drosophila melanogaster* has been isolated, cloned into TOPO vector and *E. coli* transformants selected. Processes for purification of AAT and cecropin like proteins from plant tissue matrices have been developed. Chloroplast transformation for potato has been initiated as replication from the technology developed and optimized on Tobacco. Also productivity of laccase has been optimized at a 5 L fermentor scale. The system is to be employed for the target transgene (therapeutic proteins- AAT, SOD etc.). Collagen producing sponges have been identified out of the collected germplasm and putative alpha chain of collagen has been demonstrated by SDS-PAGE electrophoresis and Western blotting.

VI Medicinal plant chemotypes for enhanced marker and value added compounds

The project envisages to enhance the production of around 20 commercially important high value drug molecules present in medicinal plants viz. *Artemisia annua, Acorus calamus, Bicopa monnieri, Cathranthus roseus, Picrorhiza kurroa* etc.

Protocols for Poly (A) +mRNA construction of cDNA libraries of leaf and root tissues, subtractive hybridization and sequencing of ESTs have been developed. A total of 150 ESTs were sequenced. Gene hunting based on EST analyses has led to the isolation of a pathway related gene namely Strictosidine β-D-glucosidase (sg) from alkaloid rich chemovar *Dhawal*. The full length sg gene has been successfully cloned on pUC19 vector and the construct has been named as pCRSG1702.

In another study of *Picrorrhiza kurroa*, seven genes of the irridoid pathway have been successfully cloned using differential display and degenerate primer approaches. Internal control gene primers have been developed for expression analyses of cloned genes.

In addition, agrotechnology packages in terms of seed rate, cultivation practices, fertilizer requirements, spacing, harvest management, intercropping patterns etc have been developed for newly developed chemovars/ chemotypes of *Andrographis, Catharanthus, Bacopa, Artemisia, Chlorophytum* and *Acorus*.

VII Development and commercial-ization of new bioactives and traditional preparation

The objectives of the project are to discover new single molecules as drugs and take them to the IND stage for diseases of concern to India and to the international community; discover and develop herbals which function through different mechanisms including metabolic activation and are based on synergism; introduce combination drugs including the use of bioenhancers which themselves are not drugs but increase the effectiveness of the drug; introduce formulations and novel delivery systems which may be target specific; and discover and develop new herbal pest management agents which influence the pests in the desired fashion but are safe for humans.

The identified promising leads for various disease conditions such as cancer, ulcer, dementia, anti psychotic, leishmania etc. are under different stages of developments. An agreement has been signed with M/s Nicholas Piramal for joint development of one herbal formulation for immunostimulotary conditions.

2.3 Chemical Science & Technology

CSIR enjoys immense credibility with the chemical industry especially in the areas of agrochemicals, catalysts, and chemical intermediates-subsectors characterized by high level of innovativeness. During the year, its chemical domain laboratories continued to work on projects having significant importance for niche sector. Some of the significant achievements of the period under report are presented below:

Scientific & Technological Achievements

Computing shapes of nanocrystals from X-ray diffraction data

CECRI developed an elegant mathematical technique and tested it for computing the shapes of nanocrystals from X-ray diffraction (XRD) data. The shapes/ habits/ morphologies of the crystals present in the material specimen can be generated from the XRD of the specimen. X-ray diffractometer, alone can be used to generate both the internal structure and the external shape of crystals.
The invented algorithm provides quantitative information, while art Transmission Electron Microscope (TEM) and High Resolution Transmission Electron Microscope (RTEM) yield only visual images. The algorithm is superbly suited to find the crystal shapes of nano-crystal and materials. Crystal shapes can be viewed from arbitrary angles. The invention assigns unique miller indices (hkl) to each of the crystal faces identified.

Novel hexaborides by molten salt technology

Novel rare earth hexaborides have attracted attention because of their interesting physical properties like high electrical conductivity, valence fluctuations and high magnetic ordering. These are promising materials in various engineering applications because of their high melting point, strength and stability. Their high thermal conductivity, ionic bombardment resistance and low work function makes them suitable materials as electron emitters in thermal emission cathodes. The electron emitters made up of these compounds are much more desirable as cathodes for higher current density applications.

CECRI has used molten salt technique to produce high purity materials (samarium and Neodymium) with precision stoichiometry. Characterization of above materials reveals that 1:6 (Nd: B) composition is more suitable for producing high purity crystals and the remaining molar ratios namely 1:8, 1:10, 1:12 are fairly good to produce crystals of NdB_6. The influence of current density has been evaluated and it is found that 1.3 & 2.3 A/Cm^2 produces good quality crystals with maximum yield.

Deposited SmB_6

NdB_6 Deposit

Electrolytic production of Ti metal from TiO_2 using molten $CaCl_2$ electrolyte

A process based on electrolytic reduction of TiO_2 to obtain Ti metal using $CaCl_2$ melt by electro-deoxygenation process has been reported by CECRI. The electrolytic cell was designed and operated at 50A capacity. After a predetermined duration of electrolysis, the cathode was removed and analysed. The cell consists of inconel retort where the reduction process was carried out. Sintered TiO_2 serves as cathode whereas circular graphite tube as

anode. The cell operates at 650-700°C with molten $CaCl_2$ as the reductant as well as the electrolyte. The final product serves as intermediate compounds of Ti as magneli phases.

Surface acidity of activated acid montmorillonite

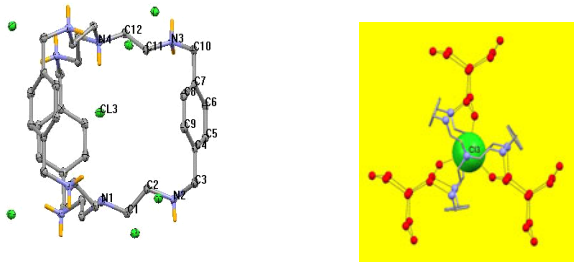
Scientist from CSMCRI studied the surface acidity of montmorillonite treated by conventional hydrothermal reaction with acids as well as ultrasonic- and microwave-assisted acid digestion using diffuse reflectance FT-IR (DRIFT) spectroscopy of adsorbed pyridine molecules. An attempt for semi-quantitative measurement of Brønsted acidity generated during the acid digestion was also carried out. The conventional hydrothermal, ultrasonic- and microwave-assisted acid digestion yields strong Brønsted acid sites of similar nature and strength, which retained pyridine up to 400–450°C. Strong Lewis acid sites have also been developed at higher temperature (>300°C), which were able to retain pyridine at 450 °C. The results show that surface acidity of similar strength can be generated with conventional hydrothermal treatment at 80°C for 4 hrs. or ultrasonic-treatment at room temperature for 1 h or microwave-assisted acid digestion for 10 min using 3N concentration of H_2SO_4. Therefore, microwave- and ultrasonic-assisted acid digestions are potential and rapid alternative methods to conventional hydrothermal acid digestion for preparing acid-activated clays. The technique offers an alternative method for preparing acid treated clays which finds extensive applications in industry.

Covalently bonded chiral Mn(III) salen complexes as efficient catalysts

Another notable development from CSMCRI has been the preparation of Chiral Mn(III) salen complex supported onto modified mesoporous supports (MCM-41 and SBA-15) using 3-aminopropyltriethoxysilane as a reactive surface modifier by a covalent grafting method. The supported catalysts shows higher chiral induction (ee, 71%) for enantioselective epoxidation of styrene and 4-chlorostyrene in presence of pyridine N-oxide (PyNO) as axial base using aqueous NaOCl (12%) as an oxidant than seen in its homogeneous counterpart 1 (ee, 48%). SBA-15-based catalyst 3, with a larger pore diameter, was found to be more active than MCM-41-supported catalyst. In addition, bulkier alkenes like indene, 1,2-dihydronaphthalene, and 2,2-dimethylchromene were efficiently epoxidized with these supported catalysts (ee up to 96%), and the results were comparable to those for the homogeneous system. It is a novel approach for the heterogenization of chiral Mn(III) salen complex where the performance of the chiral catalyst was improved for the epoxidation of styrene as compared to homogeneous system. Epoxides in high chiral purity are required as intermediates for the synthesis of various chiral drugs.

Discrete propeller - shaped undecameric water cluster

Heptahydrochloride salt of cryptand encapsulates one chloride inside the proton cage. Crystallographic analysis shows that the cage stabilized the structure of discrete propeller-shaped tricyclic water $[(H_2O)_{11}]$ clusters. This is the first ever report by IICT of a "discrete" propeller-shaped undecameric water cluster. This water cluster, oriented symmetrically around the cryptand moiety, interacts with the encapsulated chloride inside the cryptand cavity.



(a) *(b)*

(a) ORTEP diagram of heptahydrochloride salt of octaamino cryptand;
(b) encapsulated chloride and its interaction with the discrete $(H_2O)_{11}$ cluster.

Studies on water clusters in host lattice have shown that "discrete" even-membered water ring morphologies such as $(H_2O)_n$ (n = 4, 6, 8, 10, 12, 14 &16) are common within the lattice of crystal host. Curiously, little is known of the structural constraints required in stabilizing "discrete" odd-membered water cluster morphologies of "higher nuclearity" though trimers and pentamers are familiar in crystal hydrates.

Solar power operated community reverse osmosis desalination unit

The social work and research center (Barefoot college) Tilonia, Rajasthan and CSMCRI, Bhavnagar have jointly developed a solar powered community scale RO desalination unit which has been installed in the Sambhar Lake area of Rajasthan. The unit is producing 700 liters per hour drinking water from brackish water containing excess fluoride and catering to the requirement of the entire area.

First solar power operated community scale reverse osmosis desalination plant installed in the country

The electricity to power the unit is generated by 2.5KW solar panels. This is the first community scale solar powered unit set up in ndia. Efforts are under way to raise the output of the unit to 1000LPH. The people in the rural areas where electricity is not available are expected to be benefited the most.

Cultivation of Gracilaria edulis in Andaman and Nicobar Islands

CSMCRI has transferred technical know how for cultivation of *Gracilaria edulis* and extraction of agar therefrom to Community Enterprise Forum International (CEFI) who is actively engaged in empowerment of coastal communities in Andaman and Nicobar Islands through development of sustainable community enterprise for livelihood security and poverty alleviation. CSMCRI with CEFI demonstrated cultivation using raft method and imparted training to end-users in seaweed cultivation, farm maintenance, post harvesting practices in Andaman and Nicobar, who are farming this alga successfully in Andamans. The geographical conditions are conducive for the growth and the seaweed cultivators can directly reap the benefit.

Cultivation of Gracilaria edulis by costal communities in Andaman islands

Improved process for Heptafluoropropane

An important contribution from CSIR towards mitigating the Ozone layer depletion efforts,

has been the development by IICT of an improved process for Heptafluoropropane (FM-200) at 70gm/hour scale and release of the same to Centre for Environment and Explosive Safety (CEES/DRDO). The technologyhas been commercialized by M/s Mechvac Fabricators (I) Pvt Ltd., Mumbai. Other than India, the technology for making Heptafluoropropane is available only with the USA. FM-200 is a halon substitute used in fire fighting systems. As per the Montreal Protocol, halons should be phased out as they cause depletion of Ozone layer. The company has already received advance orders for 500 tonnes of FM-200 and is considering to set up three more facilities to meet the demand. The annual domestic requirement of the gas is around 750 tonnes. M/s Mechvac will be able to provide about 300 tonnes during the first year of operation set up at an initial cost of Rs.10 crore. The market size for this halon substitute is about Rs.150 crore per annum.

Heptafluoropropane plant

Synthesis of SBS triblock copolymers

Thermoplastic elastomers take an intermediate position between rubbers which are soft, flexible and elastic and thermoplastics which are rigid. These materials are used as specialty elastomers in adhesives, noise reduction applications, production of foams, films, tapes, and cable sheathing. NCL in collaboration with University of Bordeaux, France have discovered a new dicarbanionic initiator by lithium-halogen exchange reaction of dibromo compound with sec-butyllithium. This dilithiated initiator is totally soluble in hydrocarbons in the absence of any additive and efficiently generates well-defined polybutadiene telechelics and poly (styrene-b-diene-b-styrene) triblock copolymers with high 1,4-units in the polybutadiene segment. The dibromo compound viz; 1-bromo-4-(4'-bromophenoxy)-2-pentadecyl benzene used for synthesis for dicarbanionic initiator was derived from 3-pentadecyl phenol which in turn is obtained from cashew nut shell liquid (CNSL), a naturally occurring plant derived material. This dicarbanionic initiator is totally soluble in non-polar media without any additives, which allowed synthesis of well-defined polybutadiene telechelics with a high percentage of 1,4-PB units (91%). This initiator proved to be very efficient in providing SBS triblock copolymers containing 91% 1,4-microstructure polybutadiene segment with good mechanical properties (ultimate tensile strength higher than 30 MPa and elongation at break of 1000%).

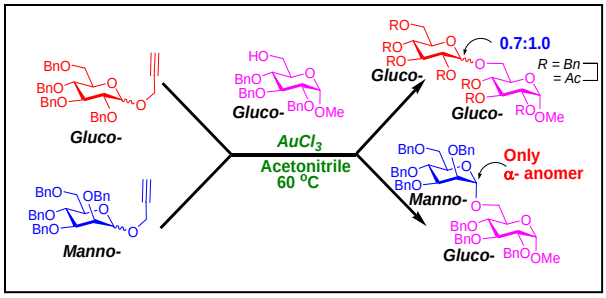
Beating the ferroelectricity limit in barium titanate nanoparticles

Among the ferroelectric oxides, barium titanate has been studied in detail both in bulk as well as in nano-size but it showed the absence of ferroelectric-tetragonal phase at room temperature when the particle size is reduced below few tens of nanometer. NCL has synthesized barium titanate particles (5 nm) using a room-temperature fungus-mediated technique in a proper crystalline phase. These particles and their composites in polymethyl methacrylate (PMMA) were investigated for the structural and dielectric properties and demonstrated that it is indeed possible to store electrical information in tiny

barium titanate particles as small as 5 nm by polarizing them at will (in reverse directions) by using atomic force microscopy probes. The electrical information thus written was directly imaged using Kelvin probe microscopy technique. This is a direct evidence of a clear ferroelectric to paraelectric (tetragonal to cubic) phase transition across the Curie temperature that could be shown at such small size in any ferroelectric material.

Synthesis of oligosaccharides and glycoconjugates

Isolation of oligosaccharides and glycoconjugates biomolecules from natural sources is a complicated task and often laborious and time consuming; hence, chemical synthesis of oligosachharides is the most sought after technique. NCL has developed a novel transglycosylation methodology for the synthesis of these biomolecules exploiting gold catalyst. A competing reaction in diversity oriented syntheses pathway development programme enabled them to identify the peculiar behaviour of propargyl group in the presence of Au(III) salts. Extrapolation of this observation led to a novel transglycosylation protocol for the glycoside and disaccharide synthesis. The procedure developed at NCL enabled conversion of stable propargyl glycosides to transglycosylated products in the presence of catalytic quantity of $AuCl_3$ in acetonitrile. Utility and efficacy of the transglycosylation was demonstrated using various aglycones and synthesized respective glycosides and disaccharides. It can be envisioned that transition metal mediated activation of propargyl glycosides would be advantageous as propargyl glycosides can be (i) synthesized from aldoses by modified Fisher glycosidation, (ii) stable to diverse chemical manipulations, (iii) directly used for saccharide coupling, and (iv) chemo-selectively activated.



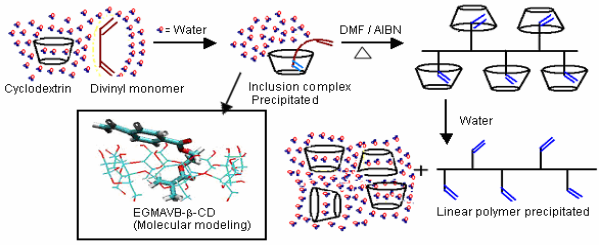
Conversion of methane and methanol into gasoline

A process having significant commercial outlook, for conversion of methane to gasoline through non-oxidative activation of methane and its simultaneous conversion with methanol into gasoline-range hydrocarbons over bifunctional ZSM-5 type zeolites has been developed by NCL. It has also been shown that the amount of methane converted could be equimolar to the amount of methanol converted in this novel process, depending on the specific conditions. Conversion of methane to higher hydrocarbons was confirmed by using carbon labeled methanol and analysis of the reaction products. In this process, methane is converted at low temperature (<600 °C) over bifunctional zeolite catalysts. Simultaneous conversion of methane and methanol results in a significant change in the hydrocarbon product distribution. The formation of benzene was very small. In the absence of methane, an appreciable amount of benzene is produced in the aromatization of methanol. Therefore, the presence of methane as a co-reactant in this process is beneficial, as the aromatization of methanol results in no net formation of benzene. The required methanol itself can be produced from methane through a well-established technology (CH4→syngas →methanol).

Functional polymers from divinyl monomers via cyclodextrin host guest chemistry

Crosslinked polymers find a wide range of applications such as ion exchange resins,

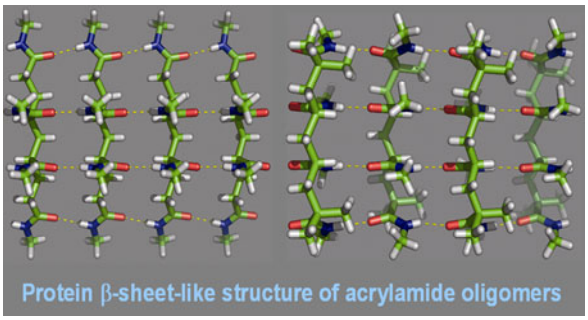
adsorbents, molecularly imprinted polymers, supports for reagents in organic synthesis, enzyme immobilization and drug delivery systems. A sequential multistep approach, wherein, a soluble linear polymer is first synthesized, isolated and then crosslinked offers significant advantages in most applications. NCL in collaboration with IICT has developed a methodology for selective polymerization of divinyl monomers such as ethylene glycol dimethacrylate and ethylene glycol methacrylate 4-vinyl benzoate by exploiting the principles of host-guest chemistry. In the methodology developed at NCL/IICT, the water insoluble divinyl monomers form an inclusion complex with β-cyclodextrin and its derivatives such as dimethyl β- cyclodextrin. The vinyl group included in the cavity of β-cyclodextrin does not participate in polymerization. As a result, a divinyl monomer behaves as a monovinyl monomer. The polymerization results in a solvent soluble linear polymer containing one vinyl double bond per repeat unit.



Biotransformation of amorphous silica in rice husk to nanocrystalline silica

An exciting futuristic biomedical application has been reported by NCL scientists wherein the use of silica nanoparticles can enhance the image quality of tumour cells, making it possible for an ultrasound device to track them and thereby detect cancers. Using the fungus *Fusarium oxysporum*, commonly found in garden soil, NCL has demonstrated that almost the entire silica present in rice husk (up to 97%) can be converted to high value nanocrystals of 2-6 nanometres in size. More importantly, the entire operation takes place at room temperatures.

Protein β-sheet-like structure of acrylamide oligomers

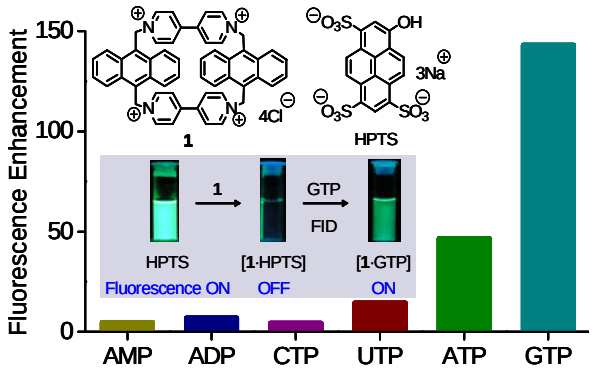


Poly-N-alkyl acrylamides are polymers formed by the polymerization of acrylamide monomer units. As a class of functional materials, these synthetic polymers are gaining prominence, primarily, due to their enormous potential for applications in various fields, from disposable nappies to micro fluidic devices and from advanced drug delivery materials to high-tech materials. NCL demonstrated that acrylamide chains form sheet-like structures similar to protein β-sheets. Isotactic acrylamide tetramers were synthesized and crystallized using a method usually used for protein crystallization. Conformation of these oligomers was investigated the by single crystal X-ray and two-dimensional NMR studies, and a layered structure was found held together by hydrogen bonds "reminiscent of protein β-sheets". This insight should help in understanding how the spatial arrangement of atoms and groups in the monomers (i.e. the stereochemistry) translates into final macromolecular shapes.

Novel cyclic conjugate for selective recognition of purine nucleotides in aqueous medium

Detection of nucleosides and nucleotides has paramount importance as they form the fundamental units of all the life forms. Of all nucleotides, the recognition of adenosine

5'-triphosphate (ATP) and guanosine 5'-triphosphate (GTP) is vital, since ATP plays an important role in energy transduction in organisms and controls several metabolic processes, whereas GTP is involved in RNA synthesis, citric acid cycle and acts as an energy source for protein synthesis. Available sensors do not work in aqueous medium since it involves multiple hydrogen bonding. NIIST has developed a highly sensitive fluorescence assay for GTP, which makes use of the beneficial non-fluorescent and selective binding properties of the receptor, highly fluorescent properties of the indicator, 8-hydroxy-1,3,6-pyrene trisulfonate (HPTS; $_F$ = 0.7). The system is unique in the sense that it differentiates between ATP and GTP involving synergistic effects of electronic, π-stacking and electrostatic interactions inside the cavity and recognizes micromolar quantities of GTP in buffer and biological fluids through a visual "turn on" fluorescence mechanism. The findings are useful in developing sensor for biologically important molecules.



Metal ion imprinted polymers

Thiruanathapuram NIIST is pioneer in trapping-based ion imprinted polymers (IIPs). IIPs have many important applications and perhaps the most important one is detoxification of synthetic nuclear power reactor effluents containing uranium - an emerging pollutant. Imprinted polymer inclusion membrane sensors have been fabricated by dispersing atrazine and dysprosium imprinted polymer materials in polyvinyl chloride matrix. The resulting devices enable highly selective and sensitive detection of atrazine/dysprosium. An on-line flow injection preconcentration-FAAS methodology were developed in analysis of dust and rock samples for palladium(II) using exfoliated graphite/inorganic or inorganic-organic hybrid materials and soils and sediment samples for cobalt using dihaloquinoline-8-ol embedded polymeric materials.

Progress Made under Network Projects

I. Development of catalysis and catalysts

The project envisages development and standardization of novel mesoporous materials that include Nano tubes and Nano particles and evaluation in catalytic oxidations.

Under this project being coordinated by NCL, several related developments have been place. the scale-up of the mesoporus materials (MCM-41 and MCM-48) up to 1 Kg level has been successfully achieved. A lab scale twin-process for the conversion of carbon dioxide and olefins/epoxides to cyclic carbonate and transesterification of organic carbonates with various alcohols has also been developed where the catalyst as well as reaction conditions are optimized. Non-noble metal based catalyst has been synthesized and found to be active for removal of NO_x from automobile engine exhaust under lean burn conditions. The catalyst (Co based) has been identified for indirect route of nitrogen utilization. Chiral ligands, their anchoring on porous support and catalytic application for asymmetric reactions has been prepared. Asymmetric hydrogenation of various

substrates like ketones, olefins, imines, enamines etc is important for the synthesis of enantiomerically pure pharmaceuticals / intermediates.

II. Developing green technologies for organic chemicals

The project being led by IICT targets to develop good processes for bioactives from medicinal plants, value-added organic chemicals from biomass and agro industrial wastes, alkylation and oxidation of aromatic compounds, fluoroorganics by chemical/ electrochemical methods and novel mesoporous nanomaterials.

Several processes for the production of medicinally important products and intermediates have been developed such as: artemesinin in batch of 5Kg; pheromone components IV (E11-hexadecene-1-ol) and V (E11-hexadecenyl acetate) (25g batch); process for Trifluoroethanol 1,1,1-trifluoro-2,2-dichloroethane (HFCFC-123) & Heptafluoropropane (FM200); and novel mesoporous materials for gas storage.

Ruthenium based complexes were used for catalytic oxidation of methane by molecular oxygen under moderate conditions of pressure and ambient temperature. The catalyst is being investigated in detail for oxidation of methane by molecular oxygen to study the effect of various parameters on the formation of the oxidation product.

Nanocrystalline TiO_2 prepared by sol-gel method was calcined at 583, 683, 753, 833, 913, and 1023 K under airflow. The photo-catalytic activities of these catalysts were tested for degradation of nitrobenzene under UV light irradiation for 1-8 hours. It was found that the catalyst calcined at higher temperature showed highest rate of degradation of nitrobenzene.

III. Globally competitive chemicals, processes and products

This network project with IICT as the lead laboratory aims to develop new generation technologies for high demand chemicals and strategically important chemicals for the country, e.g. novel bioactives, alternative fuels, new natural functional dyes etc.

- Tissue culture and processing of natural dyes Calli formation with respect to its proliferation/growth medium has been optimized. Also fresh *T. erecta* flowers (10 Kg) were produced in an experimental farm.

- Towards the development of functional dyes dipotassium rhodizonate, dipotassium croconate, barium croconate, croconic acid have been prepared at gram level. Further new homogeneous and supported catalysts on biopolymer were synthesized and evaluated for Heck reaction. Titanium Oxide electrodes have been prepared from chemical grade TiO_2 and are being characterized.

- Zeolite Molecular Sieves A and $BiCl_3$ catalyse and excellent yield of the nucleophilic ring opening of epoxides in solvent free conditions to give the corresponding β-amino alcohols. $BiCl_3$ also catalyses the nucleophilic ring opening of epoxides of styrene, substituted styrenes, 1-propene, 1-hexene, 1-octene, cyclohexene, cis-β-methylstyrene and allyl chloride by aliphatic and aromatic amines under solvent free conditions to give the corresponding β-amino alcohols in excellent yield and regioselectivity within 1.5 to 6 h.

IV Development of novel polymeric materials

The project being coordinated by NCL aims to use sustainable raw materials for the preparation of specialty polymers such as Organic-Inorganic hybrids and nanocomposites, UV/E-beam curable coatings and adhesives, functional polymers for chiral separations specialty polymers for petroleum industry and specialty polymers from renewable resources. So far highly luminescent bulky–conjugated liquid crystalline poly(p-phenylenevinylene)s and perylenebisimide derivatives materials have been developed for applications in opto-electronics.

2.4 Earth Resources & Natural Hazards Assessment

CSIR laboratories NGRI, NIO and NEIST are primarily devoted to R&D on earth resources. These laboratories continued to work during the year on R&D programmes, both through Network and Non-network modes on new hydrocarbon resource location, estimation of recharge of ground water systems, coastal and ocean science mineral explorations, seismic studies etc. as under:

Scientific & Technological Achievements

Shillong plateau earthquakes in Northeast India region

Jorhat based NEIST has examined the complex tectonic model of the Shillong Plateau, the source area of the 1897 great earthquake in the northeast India region using the high precision data of a 20-station digital seismic network that is in operation in the Plateau since 2001. The dominating thrust/strike-slip faulting earthquakes in the western Plateau although could be explained by the 'pop-up' tectonic model, the seismological data, however, shows that the north dipping Dapsi and the south dipping Brahmaputra faults are the possible boundary faults, not the Dauki and Oldham faults as were proposed in the model. The more intense normal/strike-slip faulting earthquakes in the eastern Plateau (Mikir massif), on the other hand, are generated by a long and deep rooted Kopili fault by transverse tectonics, and this could be the more vulnerable source area for an impending large/great earthquake in the region. The study has generated some seismological data which might be useful for earthquake prediction related studies.

Prediction of water table variation

A mathematical model using approximation scheme to predict water table variation in an unconfined aquifer induced by time-varying recharge and/or withdrawal from any number of recharge basins, pumping wells and leakage sites of different dimensions has been developed by NGRI. Advantage of this approximation scheme is that any complex nature of recharge and/or withdrawal rates for any number of recharge basins, pumping wells and leakage sites and for any number of these operations can be approximated with more accuracy.

Deep Seismic Sounding refraction profile of Vattalkundu to Kanyakumari

Using wide angle seismic refraction data, NGRI has derived upper crustal velocity image from tomographic inversion and its relation with compositions of different rock assemblages from the study of Vp/Vs and poisson's ratio respectively. The tomographic study, for the first time, clearly reveals these aspects by imaging shallow (8km) anomalous high Vp/Vs ratio (›1.75), large variation of poisson's ratio (0.25-0.29) in upper crust of Southern Granulite Terrain representing numerous shear zones cutting across south

block with major compositional boundaries. The dominant metamorphic event of southernmost block is ~550 Ma.

Paleo-seismological Investigations

Palaeo-seismological investigations conducted by NGRI in Upper Assam and Arunachal Pradesh, which are the meizoseismal areas of 1950 earthquake, name led to the identification of number of liquefaction features were identified along the banks of Burhi Dihing river near Dibrugarh and Duliajan areas in upper Assam. The timing of the causative earthquake was constrained through the radiocarbon and optically simulated luminescence dating of liquefaction features. About 30 OSL and 16 radiocarbon ages were obtained from various liquefaction features. The radiocarbon ages of the lower bound varied between 870± 80 to modern (about 50yrs); apart from one sample indicated the lower bound as 5080±130 yrs.

Relevance of biofilm bacteria in modulating the larval metamorphosis of Balanus amphitrite

Natural microbial communities found on different substrata exposed to the marine environment, including barnacle shell surfaces, are reported to have varying influences on the settlement and metamorphosis of competent cypris larvae. NIO has carried out experiments to compare the influence of settlement inducing compounds from the bacteria isolated from the shell surface of *Balanus amphitrite* on its larval metamorphosis. The effect of multispecies bacterial film was also assessed. The production of different molecules by the bacteria was influenced by the nutrient media under which they were grown. It was observed that the promontory multispecies bacterial film turned to inhibition mode in the presence of the adult extract of the barnacle, indicating that bacteria–adult extract interactions alter the synthesis of different compounds produced by bacteria. The studies also show that the waterborne and the surface-associated cues from the bacteria function differentially in mediating larval metamorphosis.

Glycolipids from the red alga Chondria armata (Kütz.) Okamura

NIO has isolated three distinct fractions containing polar glycolipids ($PF_{1–3}$) from the chloroform soluble fraction of crude methanolic extract of red alga *Chondria armata* (Kütz.) *okamura.* The coupling constant of the anomeric proton in ^{1}H NMR spectrum and sign of rotation indicate an exclusive configuration of the sugar molecules in the glycerolipids. Major glycolipids were identified as (2R)-2-*O*-(5,8,11,14-eicosatetranoyl)- 3-*O*-a-D galacto-pyranosyl-sn-glycerol (GL2), its pentacetate (GL_1), and (2R)-1-*O*-(palmitoyl)-2-*O*-(5,8,11, 14,17 - eicosapentanoyl) - 3 - *O*-b-D-galacto-pyranosyl-sn-glycerol (GL3). Each one was methanolysed to give the same galactosylglycerol which on ESI-MS provided a pseudomolecular ion at *m*/*z* 309 representing deacylated glycolipid with the sodiated sugar moiety. Additionally, six minor glycolipids were also identified on the basis of ESI-MS. These include a 1,2-di-*O*-acyl-3-*O*-(acyl-6′-galactosyl) glycerol (GL_{1a}), sulfonoglycolipids 2-*O*-palmitoyl-3-*O*-(6′-sulfoquinovopyranosyl)- glycerol (GL_{2a}) and its ethyl ether derivative (GL_{2b}), 1-oleoyl-2-palmitoyl-3-*O*-galactosyl glycerol (GL_{3a}), and 1,2 diacyl phosphatidyl glycerol (GL_{3b}). GL_1, GL_{1a}, and GL_{2b} are new to the literature. The novelty of the remaining identified compounds lies in the diversity of their fatty acid composition. Antimicrobial properties of these glycolipids against pathogens were evaluated. The yeast *Candida albicans* and

the bacteria *Klebsiella sp*. were as sensitive as the standard Nystatin and antibiotic Streptomycin against PF_3. Considerable activity was expressed by the same metabolite against the fungus *Cryptococcus neoformans* as compared to the control. Antimicrobial activity of glycolipids is being reported for the first time.

Formation of genotoxic nitro-PAH compounds in fish exposed to ambient nitrite and PAH

Mutagenic nitrated polycyclic aromatic hydrocarbons (nitro-PAHs) have been known to arise in the environment through direct emissions from combustion sources and nitration of PAHs, primarily in the atmosphere. NIO has reported the formation of nitro-PAH compounds in fish contaminated with PAH and exposed to nitrite (NO_2^-) in the ambient water. Electrospray ionization mass spectrometric analysis of the bile of the euryhaline fish *Oreochromis mossambicus* exposed simultaneously to field relevant, sublethal concentrations of phenanthrene NO_2 and collision-induced dissociation of selected ions revealed the presence of two strongly genotoxic nitro-PAH metabolites, namely phenanthrene-6-nitro-1, 2-dihydrodiol-3, 4-epoxide and dihydrodihydroxy acetylamino nitrophenanthrene. These two metabolite peaks present only in the bile of fish exposed simultaneously to phenanthrene and NO_2^- constituted, respectively, about 3.1 and 2.7% of the highest peak among the putative unconjugated phenanthrene metabolites in the mass spectrum. The presence of the oxidized phenanthrene metabolite dihydroxy-phenanthrene (m/z 233) in fish exposed to phenanthrene alone as well as phenanthrene plus NO_2^- suggested that oxidation of phenanthrene precedes nitration in the sequence of reactions leading to the formation of the observed nitrophenanthrene metabolites. However, the route of PAH administration seems to determine the nature of metabolites formed. Nearly 92% of the hepatic cells of the fish exposed to phenanthrene in the presence of NO_2^- were found to have suffered extensive DNA fragmentation on comet assay.

Biological indicators in relation to coastal pollution along Karnataka coast

NIO has examined marine pollutants in relation to planktonic and benthic at two locations along Karnataka coast, one at Kulai ($74^o47.74$"E and $12^o55.16$"N) receiving huge amount of industrial effluents from fertilizer, petroleum and chemical plants along with the sewage discharges. The other site Padubidri ($74^o45.74$"E and 13^o10"N) is located 20 km away, which is a typically agricultural and fishing village having no stress of industrial discharges. Although the concentrations of dissolved oxygen, nutrients and trace metals in water and sediment showed marginal differences at these two locations, the concentration of petroleum hydrocarbon (PHC) remained exceptionally high with a maximum of 1523 mg/l at Kulai which is 10 times higher than that at Padubidri (144 mg/l). Biomass and population of phytoplankton and zooplankton showed that the seasonal differences were more conspicuous rather than the regional changes. Macro and meiobenthic population remained high at both the locations during the two seasons. Phytoplankton species indicated that centric diatoms such as *Rhizosolenia, Leptocylindricus, Chaetoceros, Thalassiosira* and *Coscinodiscus* contributed to 490% of population in May and 470% in January at Kulai. While mixed population of centric, pennate, cyanophycean and dinoflagellates prevailed at Padubidri in January. The results suggest that although Kulai receives large quantities of industrial and sewage effluents responsible for alteration of the ecosystem structure, the excellent wind-driven mixing

and tidal flushing keep the waters well aerated thus reducing the severe pollution stress by dispersing the organic and other pollutants. Direct relationship of PHC with Cd and Pb as contaminants, NO_3 and PO_4 as oxidants of excess PHC further suggest that these biological parameters could serve as indicators for detecting moderately high environmental stress at Kulai, compared to Padubidri.

Methane from Sea-bed

NIO participation in the drilling and coring operations carried out by '*JOIDES Resolution'*, an American drill ship, in the Exclusive Economic Zone of India has opened up doors to new areas of exploration in the field of microbiology, geochemistry and sedimentology of gas hydrate bearing sediments. It was found that methane is available in the form of solid crystalline structures in the organic rich sediments. The methane hydrate structure is composed of methane and water molecules in a cage (clathrate) like pattern. The hydrate structure, which is otherwise stable within the *in situ* temperature-pressure conditions, rapidly destabilizes into methane gas and fresh water by the time it is brought on-board. This may be due to evaporation of hydrate when the cores were brought to the water column having higher temperature and lower pressure. A suitable technology has to be developed to harvest the existing resources.

Progress made under Network Projects

I. Study of mesozoic sediments for hydrocarbon exploration

The objectives of the project are application of new strategies of integrated geophysical studies of seismic refraction, gravity, magnetotellurics and deep resistivity sounding for the delineation of mesozoics basins in areas covered by Deccan Traps which are likely to contain oil and gas; investigation of unexplored areas for hidden Mesozoic sediments for oil and gas; and location of prospective hydrocarbon potential structures in the study area.

During the year 160 km seismic line of Umapur-Hewarkhed-Assegaon-Saur- Shirala-Brahmandwadi (W-E) has been profiled. 181 stations have been surveyed for Magneto telluric: studies. Preliminary results of 61 soundings indicate large thickness (>1.5km) of Mesozoic sediments under trap in the Burhanpur, Amravati and Jamner regions. 6000 gravity stations with zero grid interval have been surveyed for gravity studies. Topographical correction was applied to the acquired data. Bouguer and Free air anomaly maps of acquired data have been prepared.

II. Development of techniques and methodologies for exploration, assessment and management of ground water

The project aims at development of techniques and methodologies and integration of the available advanced geophysical and hydrogeochemical data to thoroughly investigate various aquifer systems in hard rocks, delineation and characterization of the fractured and Island aquifer systems to understand the recharge mechanism as well as geochemical contamination and simulation of flow and mass transport and development of techniques to simulate the process of artificial recharge and test their effectiveness for a value added groundwater management in hard rocks.

Fracture Delineation: Groundwater potential zone has been delineated through the integration of hydrogeological and geophysical data. Artificial tritium experiments reveals that secondary recharge

in granitic terrain is most significant. Source well, capture well, subsurface barrier and check dams have been constructed to ensure sustainable fluoride free drinking water supply to villages in Wailapalli watershed (A.P.). Suitable structures for groundwater augmentation have been constructed. Groundwater flow and mass transport model have been used to assess the pollution due to fertilizer in alluvial terrain and due to industry in basaltic terrain. Its impact on groundwater regime has also been studied for better management of pollutants. Another method of Soil gas radon studies helped in delineation of good potential zones as the Rn concentration was detected as high as 50000 cpm. This has led to drilling of successful bore well.

Anthropogenic Pollution : In order to assess the contamination migration, groundwater flow and Mass Transport Models of Loninala watershed, covering Unnao CETP Tannery Cluster has been simulated through development of 4 layer model in the alluvial terrain of Ganga plain. Visualization of contaminant migration (TDS plume) has been shown for next 20 years. TDS, Sulphates, chlorides and Sodium have been found exceeding the WHO limits in groundwater samples. Heavy metal concentrations are also found elevated particularly chromium, arsenic and lead in groundwater. Similarly, groundwater flow and Mass transport modeling of Chambal river sub-basin have been completed and prediction of contaminant transport for next 20 years has been made in the mass transport model.

Assessment of utilizable fresh groundwater potential on islands: Detailed hydrogeological, geophysical and chemical analysis has been carried out on Androthi island to delineate area of island vulnerable to sea water ingress. The study suggests seawater ingress during non-monsoon period in the western as well as eastern part of the Androth island. The western and eastern parts of the island where groundwater quality begins to deteriorate during the non-monsoon period, the aquifer system becomes more vulnaerable to seawater ingress. It is suggested to minimize the groundwater abstraction in these zones and implement rainwater harvasting measures to augment groundwater resources.

III. Tectonic and oceanic processes along the Indian Ridge system and back arc basins

The project proposes to concentrate on Carlsberg ridge (CR)- Central Indian ridge (CIR) and Andaman backarc spreading system to understand the tectonic and oceanic processes that are occurring at these dynamic plate boundaries.

Multi-disciplinary investigations have been conducted along the Carlsberg and Central Indian Ridge segments in the Indian Ocean by undertaking cruises onboard ORV Sagar Kanya. During these oceanographic expeditions mid-ocean ridge segments along the CR and CIR have been explored. Extraction of Helium from water samples and analysis for 3He/4He ratio were attempted for the first time on especially collected samples. Based on the analysis of the data acquired, two potential sites have been identified on CR and CIR for detailed investigations to locate active hydrothermal vent sites. Manganese-oxidizing bacteria have been encountered in the CR and NCIR segments in abundance during recent findings. These bacteria are distinguished by the formation of dark brown colonies with Mn-oxide precipitate around them. The relatively high specific activity of these mixotrophic bacteria under relatively oligotrophic conditions suggests that they may be responsible for scavenging dissolved

Mn from the Carlsberg Ridge waters and could potentially participate in oxidation.

The shipboard gravity, bathymetry and seismic data across the West Andaman Fault (WAF), a major tectonic feature in the Andaman Sea, have been analysed to infer the crustal structure and to examine the influence of WAF in controlling the aftershock pattern of December 2004 and March 2005 megathrust events. The two-megathrust earthquakes of 26 December 2004 (Mw=9.3) and the 28 March 2005 (Mw=8.6) in the Andaman-Sumatra region exhibited distinct and divergent rupture patterns, controlled by the WAF lithospheric boundary. It is suggested that the active strike-slip motion along the WAF, presence of backarc spreading coupled with increased obliquity of subduction in the Andaman Sector reduce the probability of occurrence of major or great earthquakes north of 10oN.

It is proposed to investigate these areas with high-end exploration tools such as deep-tow and ROV during the second phase of field work on chartered vessel.

2.5 ECOLOGY & ENVIRONMENT

CSIR contributes significantly in providing S&T inputs to evolve national policies and to ameliorate environmental problems. A few of its laboratories has developed expertise in air, water and soil quality management, near space environment, ionospheric chemistry, stratosphere – mesosphere coupling, 'toxic & hazardous' waste management etc. CSIR is achieving these goals both through network and non-network programmes. Significant scientific achievements are outlined below.

Scientific & Technological achievements

Drishti-Kuha

CSIR has initiated a comprehensive programme to develop a multi-scale environmental modelling and forecast platform specially calibrated for India with special concern towards high-impact weather events like episodes of extreme rainfall and fog. As a part of this programme, CSIR has christened the forecast platform 'Drishti-Kuha', to emphasize forecast based vision to manage fog. The fog forecast platform, developed and calibrated by CMMACS, has a built-in Flight Schedule Decision Support System that allows flight rescheduling based on fog forecast and management parameters. This is India's first and only Flight Schedule Decision Support System with high-resolution, long-range dynamical forecasts, developed completely in-house. CMMACS is currently involved in the implementation of 'High-Resolution Regional Atmospheric Analysis (HiRRAA) through Meso-scale Observation Network for Urban System (MONUS)'. The purpose of HiRRAA-MONUS is to develop a high-resolution data set over select vulnerable locations for model calibration and model validation. MONUS will be initially a pentad of observation stations with meteorological towers over Delhi, with subsequent expansion to other cities.

Interaction of lead with some essential trace metals in the blood of anemic children

The effects of lead on the hematological system result in inhibition of heme synthesis and anemia. ITRC has correlated the association of elevated blood lead levels (≥10µg/dL), with anemia, and some essential trace metals (iron, copper, zinc, & calcium) in children. Results indicate that elevated blood lead levels were significantly associated with risk of anemia. In addition, blood lead levels also influenced the status of essential trace metals. The correlation as established in the above study gave new insight into understanding the phenomenon of causation of anemia in children. Also the regulatory

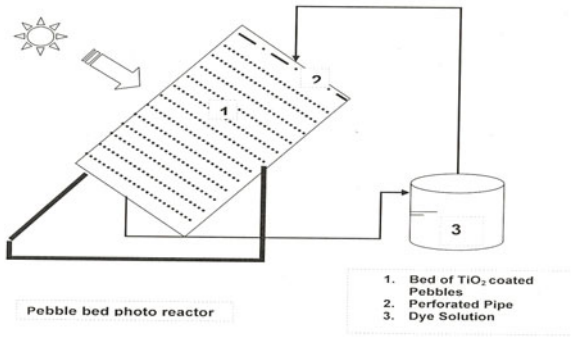
agencies are required to control overall lead emissions after even phasing out of leaded petrol in the region.

Antimicrobial, antioxidant capacity and chemical fingerprint profile of Zingiber officinale from different ecological zones of India

Zingiber officinale (*Zingiberaceae*) is one of the most utilized herbal drugs in traditional system of medicine. Its therapeutic uses include protection against throat ailments, bronchitis, dyspepsia, colic and as stimulant. ITRC has studied variation in their chemical fingerprint profile and biological activity. Camphene and Geraniol, two important constituent of the drug were found to be maximum i.e 98% & 40% respectively in sample from Madurai representing southern region. Madurai sample was also found to have highest superoxide scavenging capacity. Antimicrobial activity of these extracts was tested against seven gram +ve and gram –ve test bacteria. All the extracts showed strong to moderate antimicrobial activities against *B.cereus, B. subtilis, S.typhi, S.flexneri, S.sonnei, S.auerus, P.aeruginosa* and *E.coli.* The MIC values of *B.cereus* and *P.aeruginosa* ranged from 0.01 mg/ml to 10 mg/ml indicating strong activity against these bacteria, which was again highest in Madurai sample. Results confirm that *Z. officinale* obtained from the Madurai region of India has higher antioxidant, antimicrobial activities and bioactive constituents. The information can be useful while procuring the raw material for preparation of therapeutic formulations.

Solar photocatalytic treatment of textile wastewater

A novel bench scale pebble bed photo reactor has been fabricated by NEERI for its applicability to treat aqueous dye solutions and synthetic textile wastewater under solar illumination. Silica rich white pebbles coated with Degussa P-25 TiO_2 catalyst were used for fabrication of photocatalyst bed surface. The pebbles used as a support for TiO_2 and a pebble bed reactor have been used for first time for the treatment of aqueous dye solutions. Various experiments for optimization of parameters viz. dye concentration, pH and flow rate on the performance of reactor were conducted using artificial UV light and Reactive Black dye. The results indicate that PBPR can be successfully used for the decolorization of dyes from dye wastewater under sunlight.



Schematic diagram of solar photocatalytic treatment plant

"NEERI-Zar" portable instant water filter

NEERI has developed a water purification system 'NEERI-Zar' suitable for potable water supply particularly during floods. A typical unit, with two 100 L vessels, can serve about 20-30 persons, when operated for 10 hours a day, on the basis of 6-10 liters per capita/day for drinking and cooking purposes. It brings down the turbidity of filtered water to less than 3 NTU from raw water with 100-300 NTU. It is based on the principles of oxidation of organic matter in water, using the oxidizing chemical agent to remove organisms, and filtration through a sand bed to remove turbidity and suspended matter as well as to bring down the micro-organisms, including bacteria and zooplankton. A typical

unit comprises two plastic containers of 100 L capacity placed at elevation difference to manage gravity flow. The top container contains raw water. The oxidizing chemical solution is mixed into the raw water container placed on top. The water flows by gravity into the second container, passes through the filter bed and gets accumulated. The water coming out from the second container is collected in the third container. The disinfectant solution is added to this treated water. In usual circumstances safe potable water is ready for use after half an hour.

NEERI Zar

Progress made under Network projects

I. Pollution monitoring, mitigation systems and devices with applications to environmental assimilative capacity in select regions

The project envisages developing innovative sensors, indicators and instruments for pollution monitoring and study of assimilative capacity of environmental media for pollution mitigation. During the year under report tin oxide and ceria thick films as leak detecting sensors of SO_2 (with sensitivity down to 5 ppm) were developed, fabricated & tested. Two machines were designed and developed for automation of critical sensor assembly. Nano-crystalline polymer thin films for detection of Carbon Monoxide, HCI & NO_x have been prepared. BOD sensors (software, membrane and bioseed) for beverage and dairy waste have also been developed.

II. Industrial waste minimization and clean up

Under this project it is proposed to dematerialize the resource intensive activities of industries into more appropriate environmental technological solutions aimed at waste minimization, cleanup and remediation. It is also envisaged to go in for development of futuristic, niche and cost-effective technological interventions for at least ten highly polluting categories of industries. The work carried out has resulted in the development of several process technologies at lab scale; such as BFBR technology for insoluble COD removal; blue dust recycling from lance based smelters; microbial deodourisation for pulp & paper wastewater; photocatalytic colour removal for textile wastewaters and recycling of MnO_2 from secondary zinc industry. Enzymatic bioreactor system for pharmaceutical wastes was developed at bench scale.

III. Impact of anthropogenic perturbations on oceanographic-atmospheric processes in and around India in the context of global change

The major objective of this project is to improve understanding of natural variability (from Diurnal to decadal) and to develop the capability to differentiate anthropogenic influence through long-term time series measurements. As a network project, the result obtained during the year indicated occurrence of alkyl halides in coastal waters of the Candolim time-series section (CaTS) in Goa where their abundance varies with oxygen deficient conditions. Experiments reveal that biological processes significantly

contribute to the formation of chloroform in seawater. Atmospheric measurement laboratory is being set up at NIO, Goa. Continuous and high quality carbon dioxide measurement facility is being installed to facilitate monitoring the air quality in the central west coast of India with particular reference to changing environment and climate.

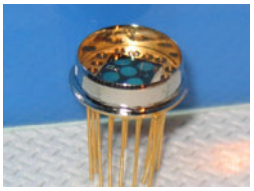
2.6 Electronics & Instrumentation

CSIR laboratories of this sector have reported the development of several specialized products, notable among them are power quality analyzer, trace moisture analyzer FBG sensor etc. Additionally, a knowledge base exists in microwave & traveling wave tubes and klystrons & magnetrons. Its capabilities in semiconductors have provided tailor-made hybrid microcircuits for the Indian space programme and other applications. CSIR's achievements are highlighted in following subsections:

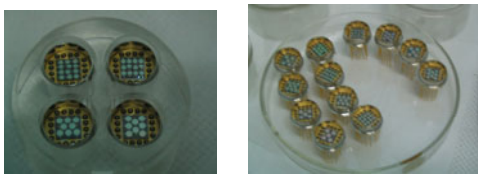
Scientific & Technological achievements

Silicon carbide Schottky diode

Silicon carbide is a wide band gap semiconductor material with higher thermal conductivity, making it viable for high power and high frequency device applications. Among more than two hundreds polytypes of SiC crystal structures, 4H-SiC is the most appropriate for devices, which is available commercially with uniformly low doped epitaxy layers of not more than 50 microns. The quality of the SiC substrate is limited by the presence of unavoidable micropipes. CEERI has developed SiC Schottky diode technology for the first time in the country, by fabricating diodes of varying diameters from 1.2 mm to 2.0 mm and packaged in TO-8 headers for direct applications. Breakdown voltage of more than 700 Volts and reverse leakage currents of 1.0-5.0 nA at 200 Volts are salient specifications of all the diodes. Ideality factor and the barrier height of the Schottky diodes have been evaluated using forward I-V data giving rise to 1.2 and 1.25 eV respectively. Nickel has been used for the realization of Schottky contact on si-face of the wafer carrying about 50.0 μm thick epitaxy layer with a doping concentration of 9×10^{-14} cm^{-3}. The c-face of the wafer of 0.020 Ω-cm resistivity has been deposited with Ti/Pt/Au for ohmic contact metallization. The technology thus developed has novelty in thermal oxidation and subsequent vacuum annealing of grown oxide and the metal films for proper adhesion to the respective faces of SiC substrate. Application of PECVD oxide for passivation and capping of grown oxide on si-face is an additional uniqueness for improved device characteristics. Field ring and field plate termination techniques have been incorporated in the diode structure to minimize multi-dimensional effect.



Packaged SiC Schottky Diode array chip in TO-8 header for detector purposes



4H-SiC Schottky Diode Detectors ready for delivery

High k HfO_2 dielectric thin film

Hafnium oxide (HfO_2) has emerged as the most promising high k dielectric for Metaloxide semiconductor (MOS) devices. As deposited sputtered HfO_2 thin films have large number of defects resulting in increased oxide charge and leakage current. CEERI has

investigated the effect of sputtering voltage, bias sputtering and post deposition thermal annealing. It is found that oxide charge increases with increasing sputtering voltage. Thermal annealing in oxygen reduces the interface/oxide charges and leakage current. It is shown that applying substrate bias during film deposition leakage current is further reduced by an order of magnitude. The microstructure of thin film is examined by Atomic Force Microscopy (AFM). The development of high k dielectric material is a step forward towards advanced gate technology for scaled MOSFET and provides an understanding of the effect of material technology on interface charges and improvement in MIM and MOS device performance.

Smart materials for temperature-sensitive applications

CEERI has developed alumina based temperature-sensitive smart materials with conductor terminations. These are based primarily on the combination of one or more of the following constituents: piezoelectric materials, glass, conducting oxides, organic binders and minor impurities in different proportions to control the resistivity, viscosity and hardness of the material. The process for development of temperature sensitive smart materials has been evolved and samples have been fabricated accordingly.

The fabricated samples are characterized with respect to temperature. They are subjected to different temperatures and the electrical resistance is measured in each case. The initial resistance of fabricated material is in the range of few MΩ and decreases drastically by several folds with the increase in temperature. Thus indicating, fast switching action in the device parameters with temperature. One curve indicates the variation in resistance with the increase in temperature while the other is with the decrease in temperature. The variation of resistance approximately follows the same path in both the cases. The change in the electrical properties with change in temperature of the developed material leading to fast switching action is being examined and could be broadly attributed to phase transformations in the material.

Paper dirt speck analyzer

a paper dirt speck analyzer has been designed and developed at CEERI using image-processing technique. As paper dirt measurement is an important parameter of the paper quality for the pulp and paper industry. The main components of the system are a PC, monitor, illumination system and image processing software for computation of dirt speck in paper. The indigenously developed instrument, using the latest available image analysis techniques, helps the paper maker in analyzing dirt specks in paper, based on physical area as well as EBA computation of the captured image of the sample paper. The instrument has field of View 40 mm x 30 mm sample area with accuracy of 0.002 mm resolution.

Optoelectronic instrument for the determination of sulphite in beverages

An instrument to measure the sulphite concentration in beverages has been designed and developed at CSIO. This selective and sensitive method for determination of sulphite is based on the reaction of pararosanline acid bleached dye with formaldehyde solution, which gives violet colored complex having absorption maxima at 560 nm. High intensity green light emitting diode (LED) of wavelength 565 nm is used as light source. BPW21 photodiode having the relative spectral sensitivity above 90% in the range of 500-600 nm has been used as a detector, for

the determination of sulphite concentration. These will lead to the development of portable device for Sulphite measurement in beverages. Instrument can be used in the field and the results are directly displayed on the LCD. There is no interference of various other cations and anions in the test solution.

Optical fiber temperature switching technique

An optical fiber switching technique for in-situ monitoring of point temperature of a process remotely developed at CSIO, is very useful for monitoring temperature in applications involving a harsh environment which could be corrosive, electromagnetically noisy, chemically explosive and hazardous. It works on the principle of guiding light by means of total internal reflection occurring in a right angled micro prism mounted on a glass capillary tube that contains a liquid in a bulb attached at the bottom.

Monitoring of railway tracks and acceleration of railway vehicles for safety determination

A tea, pf CSIO scientists has developed Oscillation Monitoring System which is an advanced portable instrument to monitor, detect and record the horizontal and vertical acceleration of the railway vehicles (railway coaches, wagons and locomotives, etc.) as well as of the railway tracks. The instrument uses 89C52 low power Micro-controller as a main component. The system continuously measures vertical and lateral accelerations at any desired location on the floor of a railway vehicle and simultaneously measures distance from fixed points of track on real time basis. The system is capable of working in non air-conditioned, harsh environment and withstands vibration of '1 g' in all three orthogonal axes. The system is designed with large storage capacity and displays locations of bad spots along with other required information. The system has been field tried in association with Research Design and Standards Organisation, Lucknow. The instrument has been installed in Track Recording Coach on the routes from Kalka to Ambala & from Ambala to Jalandhar.

Low cost power quality analyser for industrial and commercial applications

For most of the power intensive industries, quality of power is important. To meet such a need, CSIO has developed a low-cost power quality analyser (PQA) based on the state-of-the-art digital signal processor. It measures the power quality events along with basic electrical parameters in a three-phase four-wire star connected system. It detects the impulse transients, swells & sags, harmonics, phase sequence, unbalance along with basic electrical parameters like voltage, current, power factor, powers & energies.

Progress made under Network Projects

I. Special electron tube technologies for large scale applications

This ambitious project being coordinated by CEERI aims at technology development for fabrication and characterization of high power electron tubes, their components like RF windows, multistage depressed collectors, high current density cathodes and other components, plasma devices and integrated pulse power systems.

Dispenser Cathodes: Technology of graphite to graphite and graphite to alumina brazing has been developed using active alloy brazing. Dispenser Cathodes have been developed and are currently undergoing life tests at accelerated temperature. One of the cathodes has logged more than 27,000 hrs. of life without any degradation in emission. A prototype thermionic emission microscope has been developed to study the spatial emission distribution. The performance is satisfactory.

Multi stage depressed collector: An accurate micro-alignment set-up for electrodes in multi-stage depressed collector, to enhance the efficiency of space borne 140 watt K_u band Traveling Wave Tube has been developed. It embarks upon development of a generic technology for axial alignment of the four stage sub-assemblies, each containing one hollow conical poco-graphite electrode, an alumina insulator and a monel outer shell, within ±10 μm which will give enhanced collector efficiency, better than 60%, the present state-of-the-art available in India. A design of high precision mechanical fixture device has been developed for aligning the electrodes at different stages using He-Ne laser source for its coherent and stabilized characteristics in the field of Metrology. The main thrust of the work lies in accurate alignment of the annular hollow conical shaped four sub-assemblies into the MDC.

Complete Alignment Set-Up

II. Development of key technologies for photonics and opto electronics

It is proposed to develop indigenous technology and packaged products for a number of key components and devices, which play vital role in future communication technology and have enormous market potential such as Optical amplifiers, In-fibre Bragg grating, Arrayed planar waveguide components and Organic light emitting diodes (OLED).

This project has shown a commercial promise as 40 amplifier modules of C-band optical amplifier for telecom application each costing around Rs.2.0 lakh for applications in Cable TV (CATV) network have, so far, been sold in the national and international markets. 16 of them have been exported to USA after obtaining the qualification certificate from the competent authority. A few more orders are awaiting delivery.

EDFA module in the main studio of Cable Comm, Saltlake, Kolkata

FBG sensor mounted on a simulated HT (High Tension) line

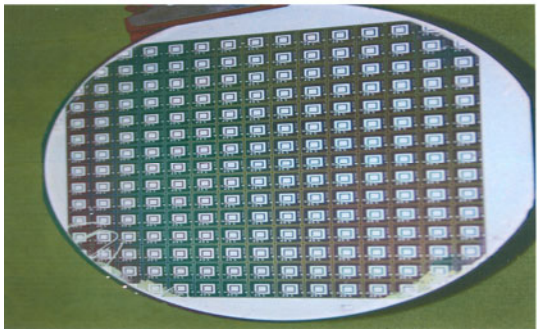
A unique facility for writing Fibre Bragg Grating and Long Period Grating has been set up to cater to the needs of both strategic and

civilian sectors of the country. The set up is now being used for producing number of Fibre Bragg grating sensors and filters on a regular basis for supplying to the users. As an off-shoot of this network activity, a sensor has been developed to measure temperature and strain of high tension transmission lines erected by M/s Power Grid Corporation of India. One such sensor has been installed at a testing site in West Bengal. This has been developed under a collaborative project with SINTEF, Norway under an Indo-Norwegian collaboration programme.

III. Developing capabilities and facilities for micro-electromechanical systems (MEMS) and sensors

The project aims at development of MEMS based chemical and biosensors, microstructures for Lab-on-a-chip type application in different chemical and biological fields, and micro-cantilever beam array biosensors. These developments are to be transferred to industry for commercial exploitation.

Fabrication of Zinc oxide based piezoelectric acoustic sensor using MEMS technology of bulk micromachined (100) silicon diaphragm could be completed at CEERI. The sensor is a sandwich structure consisting of two concentric metal electrodes, sputtered zinc oxide layer and a top metal electrode. Two capacitors, formed by the concentric electrodes, when connected in parallel, cancel the pyro-electric response. The device was fabricated on one side of the 4" diameter silicon wafer and an acoustic tunnel was made on the other side of the sensor to maintain sound pressure level inside the cavity below the silicon diaphragm. A Pyrex glass base was bonded on the backside of the device. The acoustic sensor having 5 x 5 mm2 area, 25 μm thick silicon diaphragm and 3 μm thick ZnO layer, showed an average sensitivity of 50 μV rms/Pa over a frequency range of 31.5 Hz to 8 kHz.



Acoustic sensors on 4" silicon wafer

IV. Electronics for societal purposes

The project with CSIO is the nodal laboratory aims to develop electro-optic systems for sorting, grading, packaging & storage of agricultural products, prosthetic instrumentation and medical instruments calibration and natural hazards mitigation.

During the year work on several applications continued apace Controlled atmosphere system has been developed integrated with sensors, solenoid valves, nitrogen generator and scrubbers to maintain the level of required parameters. The system is computer controlled, operated with Lab-View Software. The five parameters - temperature, humidity, oxygen, carbon dioxide and ethylene concentration levels are displayed on the computer monitor and controlled through computer. Performance testing of the system has been checked with different gas concentrations. The system is under performance trial with different fruits and vegetables. An Off-Line non destructive quality assessment system based on selective absorption of IR for fingerprinting of different attributes for apples using fiber optic probe with interference IR filters has also been developed.

Complete system has been developed at selected field site near Haridwar (Mansa

Devi). System is operational round the clock & is under observation and field data is being collected for further analysis. Test & Calibration Centers for Seismic Instruments & Networks has been setup.

2.7 Energy

In the early years CSIR played a major role in the establishment of the coal washeries in the country. It has been working on developing new approaches to coal fines beneficiation and recovery from the washeries, design of mini flotation plants etc. It has assisted the steel industry to decide on coke blends; the power industry in evolving washing strategies and the myriad of small and medium sized beehive coke units in the coal belt of India to produce coke efficiently with minimum pollution from inferior coals. It has been a pioneer in the developmental efforts in coal gasification and conversion of coal to liquid fuels. CSIR is synergising its strengths existing in different laboratories by networking to develop technologies/products required by the Indian industry. Some of the achievements are outlined below:

Scientific & Technological achievements

Sol-gel synthesis of lithium silicate nanoparticles: Scope for CO_2 sequestration

Synthesis of nanocrystalline lithium silicate by coupling of sol–gel method in reverse microemulsion has been reported by CFRI wherein the samples calcined at 800^{o}C give pure phase lithium metasilicate nanocrystallites. X-ray diffraction and transmission electron microscopy confirms the formation of nanocrystalline lithium silicate particles with a narrow size distribution. The nanoparticle prepared in the microemulsion shows enhanced CO2 sorption capacity and shorter retention times at higher temperature (~131 ml/g at STP at 610^{0} C) which are better than the best known results.

Estimation of gross calorific value of coals using Artificial Neural Network

The gross calorific value (GCV) is an important property defining the energy content and thereby efficiency of fuels, such as coals. There exist a number of correlations for estimating the GCV of a coal sample based upon its proximate and/or ultimate analyses. These correlations are mainly linear in character although there are indications that the relationship between the GCV and a few constituents of the proximate and ultimate analyses could be nonlinear. Using this approach CFRI has developed a total of seven nonlinear models using the artificial neural networks (ANN) methodology for the estimation of GCV with a special focus on Indian coals. The comprehensive ANN model developed here uses all the major constituents of the proximate and ultimate analyses as inputs while the remaining six sub-models use different combinations of the constituents of the stated analyses. It has been found that the GCV prediction accuracy of all the models is excellent with the comprehensive model being the most accurate GCV predictor. Also, the performance of the ANN models has been found to be consistently better than that of their linear counterparts.

Density measurement of coal samples by different probe gases and their interrelation

A study which demonstrates that nitrogen, which is cheaper and easily available, can be used gainfully as the probe gas for estimating the true density of coals has been carried out at CFRI. Nitrogen was used instead of the commonly employed helium, for the gas displacement pycnometer based density determination of a number of coals of Indian origin. The results show that the nitrogen-

based densities are always higher than the helium-based ones. Also, empirical relationships between the helium-based and nitrogen-based coal densities have been developed by two modeling methods, namely, multi-variable regression and artificial neural networks. Although the two models have fared well, the neural network model exhibits a relatively better prediction accuracy and generalization performance than the regression model.

Effect of gasoline composition (olefins, aromatics and benzene) on exhaust mass emissions from two-wheelers

A study which could be of significance Experimental were conducted study on in-use and new, Indian two-wheelers to study the effect of gasoline composition (olefins, aromatics and benzene) on exhaust mass emissions. Exhaust emissions of benzene were also measured. Six makes of two-wheelers consisting of popular 2-stroke and 4-stroke, mopeds, scooters and motorcycles were tested. Three test fuels, a high olefin gasoline, a high aromatic gasoline and a Euro-III equivalent gasoline were used for the study. Intake system deposit study was also conducted on 4-stroke motorcycles and two-stroke scooters having separate lubrication, using two fuels, i.e. high olefin gasoline and Euro-III gasoline, with and without the use of multi-function additives. The study results that lowering the benzene content in the fuel would greatly help to reduce exhaust benzene emissions. Multi-functional additives were seen to be very effective to control intake system deposits for the oil industry to understand the effect of fuel composition on exhaust emissions from two-wheelers, conducted at IIP shall help the industry to modify the fuel quality as per the future requirements.

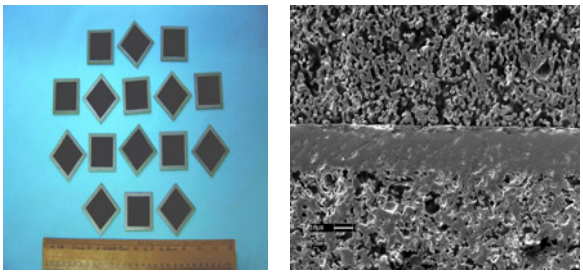
Biodegradable girth gear lubricant

In cement plant, generally girth gears are used for crushing raw materials. Currently, sprayable greases are used for the lubricant of girth gears. The consumption of these greases is about 500-600 metric tons p.a. which is being imported costing around Rs. 20-30 crores. IIP has developed eco-friendly biodegradable sprayable girth gear lubricant for cement plant at lab scale. The performance of this product is better than the existing commercial product, especially in load carrying capacity, and performance properties such as damaged load and wear weight loss. The products developed utilize low value non-edible oil as raw material against imported products, which are based on mineral oil.

Anode supported SOFC technology

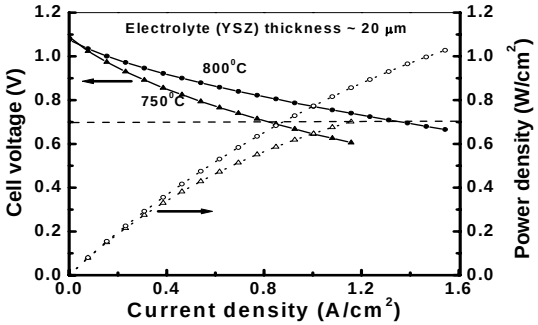
A team of scientist at CGCRI has fabricated large numbers of planar-anode-supported single cells of dimension 5cm × 5cm × 1.5mm by using simple, inexpensive and up-scalable fabrication techniques such as tape casting and screen printing. SEM micrograph revealed that the developed cells had the right kind of microstructure with a 20 μm thin, gas-tight 8 mole% yttria stabilized zirconia (YSZ) electrolyte sandwiched between a porous anode (NiO-YSZ) support (1.5 mm thick) on one side and a 50 μm thick porous Sr-doped $LaMnO_3$ (LSM) cathode layer on the other side.

The electrochemical performances of these cells were tested at Forschungszentrum Jülich (FZJ), Germany. The performance of the cells has been found to be excellent with current density as high as 1.3 A/cm^2 under a cell voltage of 0.7 V at an operating temperature of 800^oC.



(a) *(b)*

(a) Planar anode-supported SOFC single cells (5 cm X 5 cm X1.5 mm) and (b) SEM micrograph of the cross section of a typical SOFC single cell



Electrochemical performance of CGCRI developed 5cm x 5cm SOFC single cells

The performances of cells made by CGCRI are comparable with those made by other leading international SOFC fuel cell stack developers.

Progress made under Network projects

I. Coal characterization & resource quality assessment for specific end-users

The project aims at petrographic characterization and coking behaviour of coal, gainful utilization/value addition of North East (NE) coal directly or after suitably blending; developing appropriate technology for carbonization/combustion and/or after sulphur cleaning by suitable process and also the recovery of precious and rare metals from pyritic wastes, if possible; mathematical modelling for prediction of composition of gas as a function of operating parameters and properties of coal for gasification reactions. During the period of this reports. Identification of few precious metals was carried out and recovery process being tried. Pyretic washes collected for further investigative studies and artificial intelligence based models for classifying Indian non coking coals developed.

II. Quality enhancement of coal for its efficient utilisation

The project envisages to identify the optimum beneficiation strategy of non coking coals to meet the needs of different end users; to assess the effect of blending of coals, (indigenous & imported) on efficiency of power generation and evolving strategies of blending of dissimilar coals. Use of Computational Fluid Dynamics (CFD) as a modelling tool of the different sub-processes like spiral, cyclone and flotation for improving the design and performance of existing systems has also been amended as an objective.

As this study seeks to assess quality of a wide range of Indian coals samples have been collected from various sites and are being processed. Detailed full scale washability studies were carried out on two high ash coals from ECL and two coals from SECL. Washability studies carried out on two high ash coals from ECL Rajmahal coal (39.0% ash) and Chitra coal (48% ash) reveal that the theoretical yield at 34% ash are 78% and 68% respectively. Washability studies carried out on two coals from SECL Kusmunda (33.1% ash) and Baroud OCP (55.0% ash) reveals that the theoretical yield at 25% ash is 78% while for Baroud the theoretical yield at 34% ash is 29.5%.

Pilot Scale Jigging studies using Kalinga Coal of Mahanadi Coalfields Limited have been

carried out and Ep values were calculated. The tests were conducted on raw coal crushed to 25 mm and it was observed that yield of 40% at about 25% ash content is achievable.
Combustion characteristics of five raw coals (Chitra, Kusmunda, Sonepurzazari, Churi and Baroud) have been carried out in Drop Tube Furnace. The burnout efficiency of few samples was estimated from the chemical analysis of the original coal and the char samples collected from the middle port of Drop Tube Furnace using ash constancy approach.

2.8 Food & Food Processing

In the area of food and food processing, CSIR is contributing several novel and cost-effective and easy-to-operate techniques and processes for food grains storage, conservation and processing, and has developed various technologies for low cost-nutritious foods, and food preservation, convenience foods, non-conventional foods, spice products, fruit & vegetable preservation, packaging & transportation, besides appropriate and improved designs for a range of machinery for processing, milling etc. Three network programmes are being implemented in this area.

Scientific & Technological achievements

Consortium for degrading DDT

Persistent use of organic pesticides such as dichlorodiphenyltrichloroethane (DDT) and related compounds are of environmental concern because of their toxicity, high persistence and resistance to degradation and liability to bioaccumulation. CFTRI has developed a defined microbial consortium, capable of degrading DDT. The microbial consortium consists of ten bacterial isolates, of which seven are of *pseudomonas* species and three are of *flavobacterium*, *vibrio* and *burkholderia* species. Degradation parameters were optimized using Response Surface Methodology. The optimized conditions were inoculum concentration: 1500μg protein/mL and temperature: 25°C. pH was varied for different concentrations of DDT. The model has been validated.

Specialty fat powders for use in various food formulations

Fat is an inseparable ingredient of most foods as it imparts desirable textural and organoleptic properties. Fats in natural form have certain disadvantages, mainly in terms of handling and mixing. CFTRI has standardized the formulations and process for preparation of speciality fat powders containing up to 75-80% fat. Casein, whey powder and skim milk powder (SKMP) were found to be the desirable encapsulating agents and spray drying was preferred process. Of these, casein was found to be better in obtaining powders with high fat content. Bulk density of fat powders ranged from 0.30 to 0.47 g/cc. The powder prepared using whey powder was found to have least density and that prepared using casein and SKMP had the highest density.

Enzymatic maceration of jackfruit (Artocarpus heterophyllus) pulp for quality juice production

It is rather difficult to extract juice from jackfruit pulp due to its highly viscous nature and the presence of 2.1 % pectin (as % calcium pectate) and 1.18 % starch. CFTRI has screened enzyme preparations for jackfruit pulp maceration and optimised enzymatic maceration processing conditions of the jackfruit pulp. The combination of various concentration of pectin degrading enzymes and starch degrading enzymes have been found to be the best enzyme formulation, than the individual enzymes such

as *Pectinase* (CCM), *Biotropicase* and *Trizyme* employed in the jack fruit juice processing. The combination of various enzymes exhibit different degrees of activity when employed to reduce the viscosity of jack fruit pulp. The combination of pectin degrading and starch degrading enzymes rapidly reduces jack fruit pulp viscosity and facilitates smooth juice extraction which could be filtered or centrifuged easily. The effect of enzyme concentration, incubation time and their complex interactions on juice yield, viscosity and juice carotene content in the maceration process have been studied by using optimized process conditions. The process has been scaled up at pilot plant level.

Identification of the gene for pungency in chilli

Chilli is a spice known world over for its pungency as well as its red colour. The pungency is attributed, mainly to capsaicin which has wide application in food, medicine and as pharmaceutical. There is worldwide interest to identify the gene responsible for the pungency but there has been no clear demonstration of the critical step in the formation of capsaicin. CFTRI has done extensive studies on the formation of capsaicin in chilli fruits, where in the enzymatic condensation of vanilylamine and 8-methyl nanenoic acid leading to capsaicin was carried out leading to the enzyme, capsaicin synthase, which has been purified for the first time and its amino acid composition in the n-terminal determined. Based on this, the gene (csy-1) responsible for pungency has been cloned and sequenced. The functionality of the csy-1 has been demonstrated using expression vector– *E. coli* which produces the recombinant enzyme. This has implications in regulation of capsaicin in *Capsicum* genotypes.

Virgin Coconut Oil

Virgin coconut oil (VCO) which is colourless and possesses an intense coconut aroma is what every user looks for. CFTRI now has a process ready for CDO, which is rich in lauric fatty acid and contains vitamin E with a peroxidase value of below 1 and less than 0.2% free fatty acid (FFA). It has a long shelf life due to its inherent anti-oxidant properties. It has the longest shelf life compared to other vegetable oils. VCO is abundant in medium chain fatty acids such as C8, C10 and C12, and has a unique role in the diet as an important physiological functional food. It is used as a hair conditioner. It softens the hair and conditions the scalp. Using the coconut oil as a pre-wash conditioner can rid a person of dandruff better than a medicated shampoo. VCO has been recognized for its quality of strengthening the structure of damaged, devitalized hair. It lubricates and softens the hair shaft through the action of minerals such as magnesium, potassium, calcium and iron. As a “functional food” this acts as antibacterial, antiviral and anti-fungal.

Progress made under Network Projects

I. Positioning Indian nutraceuticals and nutrigenomics in a global platform

The project envisages repositioning India’s leadership in the area of nutraceuticals and nutrigenomics through study of molecular basis of bioactives for the preventive, curative and management of several systematic and chronic ailments. The focus is on the health benefits from a variety of plant resources and their ingredients, which may ultimately pave way for this approach called nutrigenomics.
During the period under report, work continued apace on several distinct yeat related objectives the pentapeptide was chemically synthesized and the later purified by HPLC. The sequence of the peptide was

evaluated by amino-terminal sequence analysis. About 900 mg of the pure peptide and acetone powder of porcine kidney was prepared for further studies on ACE inhibition using human cell lines. Arachin, the major storage protein of groundnut (*Arachis hypogeae*), was isolated by ammonium sulfate precipitation. Methodology for the isolation of polyphenol enriched fraction from one source and for one product has been standardized. A green processing technology has been developed for the production of steviosides from *Stevia rebaudiana* dried leaves.

II. Nature, nature-identical or similar biomolecules

India is a country with rich biodiversity and also with established traditions in use of biomolecules for health, nutrition and a host of other useful purposes. In spite of huge demand for such biomolecules throughout the world, their availability is limited and the country even depends on import of a number of biomolecules. The project targets to develop commercially exploitable biomolecules.

The process conditions were optimized for the preparation of radical scavenging conserve from the pruned and coarse tealeaves. The extraction of the waste leaves of *Tectona grandis* has been carried out using polar and non-polar solvents such as hexane and methanol. Solidification of the gummy extract has been tried using different techniques. The maximum yield (14.80%) of the colouring substance was obtained with methanol solvent system.

An eco-friendly process has been developed for the extraction of vanillin from vanilla pods using microwave & ultrasound processes. A convenient HPLC/GC method has been developed for the quantitative determination of phenolics compounds, present in the vanilla extract

III. Establishment of genetically modified food referral facility

It is imperative for the Government to have testing or referral centers in place with well-developed robust methods to accurately quantitate Genetically Modified Organisms (GMOs) in foods and food ingredients to assure compliance with threshold levels of GM products and evaluate their safety. The project aims to establish a referral center for food and food products, which will boost export of these items based on their declared absence or presence of the GM component.

An exclusive GMO referral centre of excellence with the state-of–the-art facilities has been established and it is fully functional. DNA extraction methods from different food matrices and verifying the purity of the isolated DNA by electrophoretic methods and spectrophotometric method were optimized.

PCR-based screening methods including nested PCR for detecting the regulatory elements (CaMV P35S and TNOS3), specific plant species genes soya/maize (Le 1, Zein and invertase), construct specific genes of herbicide tolerant soya and insecticide tolerant maize (CP4-EPSPS and cry1A (b)) have been developed and validated. These methods are being accredited to NABL 17025 standards. ELISA based methods for detection of CP4-EPSPS in herbicide tolerant soya and Cry1 A (b) in insect tolerant maize are in place. Real time-PCR methods using TaqMan probes for quantitation of CaMV 35S in herbicide tolerant soya and insect tolerant maize have been optimized and are in place. The detection limits for all the above methods are 1% GM at > 99% confidence level.

A number of primer pairs were designed to amplify different regions of the transgene both in maize and soya. In total over 20 different segments of the transgenes of insect tolerant maize (MON 810) and pesticide tolerant soya (RUR soya) have been detected in spiked GM biscuits.

2.9 Health Care, Drugs & Pharmaceuticals

CSIR has developed several cost effective and innovative processes for many a generic drugs. Several herbal drugs were standardized and pharmacopeial standard for Ayurvedic drugs were laid. In addition, CSIR is developing cost-effective and commercially viable technologies for a wide range of essential drugs, such as anti-cancer, anti-virals, anti-bacterials, anti-glaucoma, anti-inflammatory, analgesics, and cardio-vascular among others. This has given much needed fillip to Indian drug industry to emerge as the largest producer of generic drugs in the world. CSIR laboratories are working in network mode within themselves and with some pharmaceutical companies. Some of the significant achievements project-wise are given below:

Scientific & Technological Achievements

Apoptosis in liver during malaria: Role of oxidative stress and implication of mitochondrial pathway

A team of researchers from CDRI has shown for the first time that malarial infection induces hepatic apoptosis through augmentation of oxidative stress. Apoptosis in hepatocyte has been confirmed by TUNEL assay and caspase-3 activation. Gene expression analysis indicates significant down-regulation of Bcl-2 and up-regulation of Bax expression in liver of malaria infected mice. Confocal microscopy showed translocation of Bax from cytosol to mitochondria in apoptotic hepatocyte, resulting in opening of permeability transition pores, which in turn decrease mitochondrial membrane potential and induce cytochrome c release into cytosol. Generation of hydroxyl radical (-OH) in liver during malaria, was significantly inhibited by administration of (-OH) specific antioxidant as well as spin trap, alpha-phenyl-tert-butyl-nitrone in malaria-infected mice suggesting implication of oxidative stress induced-mitochondrial pathway of apoptosis in the pathophysiology of hepatic dysfunction in malaria.

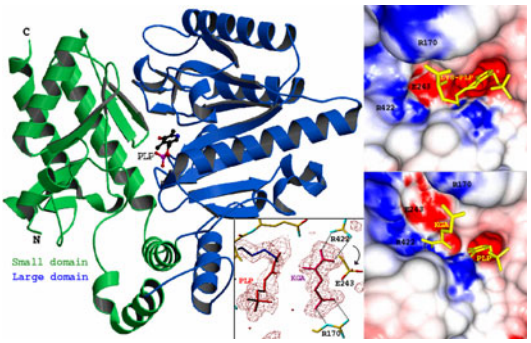
Novel approach for designing antibacterial peptides

A novel approach for designing antibacterial peptides with modulation of toxicity against hRBCs by employing the leucine zipper sequence has been reported by CDRI. Leucine residues at α- and/or δ-position substituted with single or double alanine residues exhibited antibacterial activity against the tested Gram positive and Gram negative bacteria. Substitution of alanine progressively lowered the toxicity of Leucine Zipper Peptide (LZP) against human red blood cells (hRBCs) as it impaired the binding and localization of LZP to hRBCs, but had little effect on the peptide-induced damage of *Escherichia coli* cells. Although LZP and its analogs exhibited similar permeability, secondary structures, and localization in negatively charged membranes, significant differences were observed among these peptides in zwitterionic membranes.

Cloning of Lysine epsilon-aminotransferase

Yet another significant development from CDRI is the cloning and characterization of Lysine epsilon-aminotransferase (LAT) a Pyridoxal 5'–phosphate (PLP) - dependent enzyme, highly up-regulated in nutrient-

starved tuberculosis models. The crystal structures in the unliganded form, external aldimine with L-lysine, with bound Pyridoxamine 5'-phosphate (PMP) and C5 substrate alpha-ketoglutarate has been reported for the first time. The structures reveal a Glu243 'switch' through which the enzyme changes substrate specificities. The unique substrate L-lysine is recognized specifically when Glu243 maintains a salt-bridge with Arg422 while the binding of the common C5 substrates L-glutamate and alpha-ketoglutarate is enabled when Glu243 switches away and unshields Arg422. This 'glutamate switch' is an elegant solution devised by a subgroup of fold type I aminotransferases for recognition of structurally diverse substrates in the same binding site and provides for reaction specificity. The structures have been used to identify novel inhibitors using virtual screening approaches and these will be evaluated against persistent models of tuberculosis.



X-ray crystal structures of M. tuberculosis Lysin ε-aminotransferase, a protein upregulated ove 40-fold in latent/persistent models of tuberculosis

Progress of Candidate drugs in clinical trials

Over the years CDRI has developed many drugs, some of them are under clinical trials such as:

α, β-Arteether (antimalarial drug): Multi-centric clinical trials for pediatric use have been completed in >230 children suffering from *P. falciparum* malaria. The response has been quite satisfactory.

Compound 80/574 (lipid lowering): Phase III clinical trials are in progress at four medical centers in collaboration with M/s Cadilla Pharma Ltd.

Picroliv (hepatoprotective herbal preparation): Phase III clinical trials are in progress in patients of tuberculosis receiving MDT and in patients suffering from alcoholic cirrhosis.

Compound 97/78 (antimalarial): Pre-clinical studies including pharmacology, toxicology, pharmacokinetics and metabolism in rodents and monkeys have been completed in collaboration with IPCA Labs. Dossier submitted to DCG(I) for permission to initiate Phase I clinical trials and an IND application has been filed during the year.

Molecular and functional analysis of whiB genes of Mycobacterium tuberculosis H37Rv

The *whiB* genes are present in all the genera of actinomycetes including *M. tuberculosis* H37Rv and *M. leprae.* Almost all organisms have multiple *whiB* like genes and their number may vary between the species. These are small proteins between 9KDa to 19KDa and amino acids sequence alignment shows that though both N-terminus and the C-terminus of these protein show strong divergence, the central region is conserved, IMTECH has deciphered the function of two of these genes of *M. tuberculosis* H37Rv. It has been shown for the first time the biochemical properties of these proteins have properties similar to thioredoxin like proteins and may be part of the redox network of *M. tuberculosis*. At least for WhiB1 the *in vivo* target is known.

Altered expression and glycosylation of plasma proteins in rheumatoid arthritis

During the year IGIB researchers investigated the changes in the Concanavalin-A(Con-A)-bound plasma proteins in rheumatoid arthritis (RA) patients in comparison to that of the healthy controls. The 2-D PAGE analysis of the Con-A-bound plasma samples shows a large number of protein spots, a few of which were differentially expressed in the RA patients. Some unidentified proteins were also detected in the RA patients, which were absent in the controls. The study enunciates the role of carbohydrates as well as that of the acute phase response in the disease pathogenesis.

Evidence of linkage and association on 18p11.2 for psychosis

The genetic basis of bipolar disorder (BPD) and schizophrenia (SCZ) has been established through numerous clinical and molecular studies. Although often considered separate nosological entities, evidence now suggests that the two syndromes may share some genetic liability. Several chromosomal regions are reported to be shared between these syndromes (18p, 6q, 10p, 13q, 22q). IGIB has reported a positive linkage and association finding at 18p11.2 for psychosis. Two-point linkage analysis performed on a series of 52 multiplex pedigrees with 23 polymorphic markers yielded a LOD score of 2.02 at D18S37. An independent set of 159 parent offspring trios was used to confirm this suggestive finding. The TDT analysis yielded support for association between the marker D18S453 and the disease allele {chi(2) = 4.829, P < 0.028}. This region has been implicated by several studies on BPD. The findings provide an independent validation of the above reports, and suggest the presence of susceptibility loci for psychoses in this region.

Small cationic protein from a marine turtle

Egg white of marine turtle *Caretta caretta* contains a small cationic protein but lacks lysozyme. IICB has sequenced the protein by a combination of sequential Edman degradation, carboxypeptidase digestion, nuclear magnetic resonance (NMR) and electrospray ionization tandem mass spectrometry. The protein contains 36 amino acid residues of which six are half-cysteines. The three-dimensional structure of the protein was deduced from two-dimensional NMR experiments and was observed to be similar to vertebrate beta-defensins. However, disulfide connectivity is C1-C6/C2-C5/C3-C4 different from that of the vertebrate beta-defensins. The protein showed strong antibacterial activity against *Escherichia coli* and *Salmonella typhimurium*. The protein also shows significant antiviral activity against an enveloped rhabdovirus, Chandipura virus, which is an emerging human pathogen. This virus is also closely related to the vesicular stomatitis virus, whose growth was also inhibited. This small cationic protein is a part of the innate immunity of this organism and replaces lysozyme in the egg. It has the potential to be developed as an antibacterial and antiviral agent.

Herbal extract and a molecule from Murraya koenigii for the treatment of prostate cancer

A herbal formulation as well as an extract and composition obtained from *M. koenigii* and *Tribulus terrestris* have been found to be useful for the treatment and remedy of prostate cancer as per a study reported by IICB. It also deals with a process for the preparation of the said formulation that contains extract and synergistic effects of the combined extract obtained from the above plants on androgen-dependent and – independent prostate cancer cells.

Bioactive fraction from plant Woodfordia fruticosa

A molecule isolated from the flowers of *woodfordia fruticosa* at IICB has been found to be useful as an anti-peptic ulcer. The molecule exhibits a strong gastric proton pump inhibitory activity as well as acts as a good anti-*H. pylori* activity. Such dual property in one molecule is unique and augurs well for managing gastro-deodenal ulcers, since *H. pylori* and HCl are the two major causes of peptic ulcer diseases. Patent application designating several countries has been filed.

Effect of UV radiation on ciprofloxacin users

Ciprofloxacin is a widely used fluoroquinolone drug with broad spectrum antibacterial activities. Clinical experience has shown incidences of adverse effects related to skin, hepatic, central nervous system, gastrointestinal and phototoxicity. India is a tropical country and sunlight is abundant throughout the day. In this scenario exposure to ambient level of ultraviolet radiation (UV-R) in sunlight may lead to the harmful effects in ciprofloxacin users. ITRC has made the phototoxicity end point shows a time and concentration-dependent statistically significant ($p<0.001$) damage. Ciprofloxacin produced reactive oxygen species ROS by Type I and Type II photodynamic reactions, interacted with nucleic acid moiety and inhibited cell viability. Further, UV-induced photo-peroxidation of linoleic acid accorded the involvement of ROS in the manifestation of drug phototoxicity. Appearance of ciprofloxacin induced phototoxicity at the ambient level of sunlight is a real risk for the people of India and other tropical countries. It is suggested that sunlight exposure should be avoided (specially peak hours) during ciprofloxacin treatment.

Progress made under Network Project

I. Asthmatic and allergic disorders mitigation mission

The emphasis is on to explore the mechanism of actions of the preparations / molecules on specific target sites to strengthen the claim with a view to mitigating asthmatic and allergic disorders covering biochemical, immunological, genetical and pharmaco-logical aspects.

In vivo anti-asthma activity testing of two lead molecules have been carried out. *In vivo* toxicity studies on above molecules suggest that both the molecules have wide therapeutic window. Preliminary data have already been generated on *in vivo* anti-asthma activity and toxicity on another one lead molecule and appears promising. Pharmacokinetics study on one lead molecule has been completed and the studies with the other molecules have been initiated. One corporate house is agree in principle to file patent and license out the potent anti-asthmatic molecule.

II. Newer scientific herbal preparations for global positioning

The project aims to develop effective standardized herbal formulations for use as health promoters, or for treating various disorders, adaptogens and immunomodulators etc. During the year a Clinical Research Organisation (Nicholas Piramal Research Centre, Mumbai) has been identified for undertaking proof of efficacy studies on a few of Positive Health Promoters (PHP) isolated under this project. MoUs have been signed with two hospitals in Mumbai where the proof of efficacy studies is to be undertaken.

III. Predictive medicine using single and repeat polymorphism

This project being coordinated by IGIB proposes to build an Indian SNP (Single

Nucleotide Polymorphism) database of common diseases and drug response related genes. Such a database is in the larger interest of human health in general and predictive medicine & drug response in particular in the country.

It is known that there are one million genotypings on disease candidate as well as drug responsive genes from 55 distinct populations covering all the major geographical zones representing individuals with different ethnic and linguistic origins (Indo European, Dravidian, Tibeto Burman and AustroAsiatic). This is the first comprehensive analysis of the Indian population with respect to disease predisposition and drug response genes. Analysis of this data has revealed the following:

- contribution of language and ethnicity to genetic heterogeneity in the Indian subpopulations;
- different degree of relatedness of Indian subpopulations to different global populations typed in the International HAPMAP Consortium to the same extent;
- identification of a set of 23 reference populations which cover majority of the genetic spectrum of the Indian population; and
- development of a suite of novel computational programs for large scale variation in data handling and data analysis.

IV. Drug target development using *in-silico* biology

The project aims to create and develop in-house capability in drug target development using *in-silico* biology; to design programmes for developing new software, which enables identification of therapeutic targets; to design and develop new tools for predicting toxicity and drug response *in-silico*; and to generate qualified and trained IT professionals for pursuing research in the area of bioinformatics. During the year a novel method for human GPCR protein prediction in human genomes has been developed. Also the non coding DNA motifs have been validated experimentally as potential targets.

V. Animal models and animal substitute technologies

The project aims to influence the process of new drug development and toxicity/ safety evaluation of drugs/chemicals. It is envisaged to introduce state-of-the-art technologies for new drug development, which will reduce the average time taken for development of new drugs by 2-3 years from the current average of 12-14 years in addition to providing better understanding of the drug action and targets.

Various approaches were worked on during the period, as elucidated below. Dopamine DA-D2 receptor binding assays were carried out in a human neuroblastoma cell line for neurotoxicity assessment using cypermethrin. Neuronal and glial cells of rat were cultured and used as *in vitro* tool to study the mechanism of action of deltamethrin induced neurotoxicity. Estrogenic potential of plant origin was evaluated using a cell line by E-assay. Balb/c 3T3 and C3H10T1/2 cell transformation assay using murine peritoneal macrophages as short term tests for evaluating carcinogenic potential of chromium established and validated.

In vitro models for phototoxicity evaluation of the chemicals and industrial effluents were developed and validated. Alternates to animal models (Earthworm, Daphnia, pond snail) were developed and used for ecotoxicity evaluation of heavy metals and pesticides. Growth profiles of different transgenic

mycobacterial strains of *M. aurum* were studied.

Microarray whole-genome expression profiling of central nervous system was carried out at various time-points. Further, 96 well format for GFP assay standardized for single and multicopy promoter GFP fusion assays. Gene expression profiling of STR4Δ strain exposed to *homocysteine, cysteine, S-adenosyl Methionine* and *S-adenosyl homocysteine* singly or in combination has also been carried out.

VI. Advanced Facility for the Safety Evaluation of Genetically Engineered/ Modified Drugs

The project aims to identify the available GM food crops using recent DNA based molecular biology techniques, to develop chip-based diagnostics for the detection of GM foods and to assess their safety evaluation.

Methods have been standardized for biophysical analysis of therapeutic proteins such as recombinant erythropoetin, streptokinase, insulin, interferon, HepB vaccine, etc. Several companies are already making use of the expertise acquired for biophysical analysis of their drugs (batches of drugs already in the market as well as those, which are under development) and testing for the presence of known and unknown impurities.

Data have been generated on few standard materials available in the market, particularly carbohydrate content, glycosilation and biological activity of different batches and different makes of Erythropoeitin.

Analytic procedures for micro-analytical techniques such as protein characterization, tryptic peptide fingerprinting, and N-terminal protein sequencing have been standardized.

Laboratory experiments on cell cultures (mouse fibroblast L929) were carried out for cytotoxicity (growth inhibition/cell death), mitogenic stimulation, receptor binding, inhibition of mitochondrial oxidation, etc. using reference standards. The data will be used as base line response of normal/control cell population for comparison of responses on exposure to model GM-drugs in their safety evaluation. OECD-GLP guidelines # 14 for in vitro testing, as made applicable with effect from December 2004 are used towards these studies for their global acceptability.

2.10 Housing & Construction

CSIR has developed techniques and technologies covering the whole gamut of construction activities right from foundations to construction equipments. Newer and innovative building components developed have greatly helped the building industry to standardize optimal structural elements. In the area of structural engineering, CSIR laboratories have specialized in making design and analysis of special and complex structures such as high rise, long span, suspended, offshore, ships etc. and in the integrity assessment of these structures. CSIR is also known for its contribution to the roads sector through designs and constructions techniques of rigid and flexible payments using local skills and material resources. CSIR is excelling in these areas both through network and non-network modes.

Scientific & Technical Achievements

Low cost house in areas affected by natural disaster

AMPRI has developed low cost houses especially for areas affected by natural disaster. The house can cater to the needs of thousands of families affected by natural

disaster like earthquakes, floods, tsunamis, storms etc. The key features of the house are: weight: 500 kg; fast and easy transportation; easy to assemble and transportation of 20 houses at a time; convenient and durable foundations dismantle; fire retardant; cost effective (twin house costs Rs. 42,000 approximately).

Wood substitute from red mud

An R&D application having societal relevance has been the development of a wood substitute using red mud/ fly ash and organic fibre as a reinforcement in polymer matrix by AMPRI. Huge quantity of fly ash generated from thermal power plants can be used as raw material in building components. Composite doors and panels possess properties which are comparable to natural wood and thus could be used as a wood substitute for doors, windows, ceilings, flooring, partition and furniture. The cost of product is lifetime cost, which is inclusive of its maintenance cost.

Alkali activated cold setting fly ash building brick with ash content more than 80%

Scientists from IMMT have developed a technology to use 80 to 95% (weight) of fly ash by alkali activation process in the manufacture of cold setting building bricks. The process has been developed to optimize the mix design, preparation of chemical activator and utilization of pond ash and other wastes in the production of building construction bricks and block-like products. The products demonstrate 1350 to 1650 kg/m^3 dry bulk density, 8 to 16% water absorption and 70 to 120 kg/cm^2 in bricks and 150 to 350 kg/cm^2 in block as the crushing strength. The alkali activated fly ash bricks are superior in strength, durability and chemical and heat resistance as compared to other building bricks. The production cost of a brick (230 × 110 × 75 mm^3 size) is estimated to be about Rs.1.45.

Code of practice/standards/specifications

Technical know-how in preparation of standards and specifications is a niche domain of CRRI. Such standards are then get approved by Ministry of Shipping, Road Transport and Highways, which then get implemented onto the field. Following codes have been prepared/developed during the year.

- Specification of Paving Bitumen (IS:73-2006) by Bureau of Indian Standards (BIS).
- Specification for Precast Concrete Blocks for Paving (IS 15658:2006) by Bureau of Indian Standards (BIS).
- Code of Practice for Tack Coat and Prime Coat Applications (Approved by Flexible Pavements Committee of IRC).
- Construction of Slurry Sealing and Micro-surfacing (Revised draft submitted to Flexible Pavements Committee of IRC).

Studies regarding Landslide and Rockfall on Mumbai-Pune Expressway

Country's first Expressway, i.e. the Mumbai-Pune which passes through the mountainous and rugged Deccan trap province faces major problems of rockfall/landslide. During 2003 and 2004, a significant number of accidents and casualties have been reported because of rockfalls/landslides. The existing rockfall problem, if not timely and appropriately addressed, may accelerate its intensity as well as magnitude further causing lot of damage to infrastructure and may also lead to loss of life and further hardships to the commuters. CRRI in consultation with Maharashtra State Road development Corporation (MSRDC) has identified thirteen sensitive rockfall/landslides locations which have already been activated and are prone for further failure. The extensive investigations reveal probable

causes and the mechanism of the rockfall/landslide. Appropriate short term and long-term remedial measures like steel fibre reinforced shot crete, soil nailing, wire mesh, provision of drainage system etc have been suggested for specific locations.

Landslide and Rockfall Site o Mumbai-Pune Expressway

Utilization of copper slag as fine aggregate in cement concrete

Copper slag produced as a by-product of metallurgical operations is an inert material with physical properties similar to natural sand. A laboratory study was carried out by CRRI to investigate the potential of using copper slag as a partial replacement of sand in cement concrete. Slag was used in Pavement Quality Concrete (PQC) as well as in Dry Lean Concrete (DLC) mixes and its influence on workability, compressive strength, and flexural strength was determined. It has been reported that use of copper slag in concrete have no adverse effect on its strength blend of copper slag and fine sand with slag up to 40 percent can be used as fine aggregate in pavement quality concrete as well as in dry lean concrete. The study would help in effective handling of disposal of copper slag waste and would save precious land area apart from providing and saving road construction material.

Bridge distress diagnostics system software

A software module of Bridge Distress Diagnostics System which is capable of taking input of bridge inventory data and bridge inspection data has been developed by a team at CRRI. After analyzing the bridge inspection data, the severity of damage and guidance on Non destructive testing (NDT)/Partial destructive testing (DT) to be conducted are provided by the software. Further, the software is capable of analyzing the NDT/Partial data/results to confirm the cause of distress.

Blending of non-biodegradable plastic wastes for use in road construction

A development which has a great implication in plastic waste disposable and its end-use is using non-biodegradable plastic wastes for the development of modified bituminous mixes in road construction. CRRI has studied the feasibility of using various types of non-biodegradable plastic wastes viz. polyethylene (PE), polyprophylene (PP) and polyvinyl chloride (PVC) were tried for disperse in bitumen phase. The study shows that PE and PP are partially dispersible in hot bitumen, however PP needs 20^{o}c higher temperature than PE to have better melting and dispersion. It has also been reported that marshall stability retains stability and indirect tensile strength of modified Bituminous Concrete (BC) mixes are significantly higher than that of conventional BC mixes.

Passive energy dissipation device

A passive energy dissipation (PED) device using SMA wires as energy dissipation elements has been designed and fabricated at SERC. For this PED, SERC has carried out static and dynamic tests on 0.4mm and 1.2mm diameter shape memory alloy (SMA) based nickel titanium alloy wires for evaluating the

static and dynamic characteristics such as ultimate tensile strength, frequency dependency and number of cycles to failure. The device consists of two concentric pipes that move mutually in opposite directions when subjected to cyclic loading. The test results reveal that SMA based PED devices are effective in providing energy dissipation to reduce the dynamic or seismic deformations. In addition, the re-centering capability combined with large energy dissipation assures good displacement control in the case of strong seismic events thus validating the developed PED device.

Polymer modified fibre concretes

Polymer modified fiber concretes are found to be ideal for seismic applications with their inherent improved ductile characteristics. Enhancement of ductility and the post-peak behaviour are of special interest for the seismic design of structures. SERC has simulated the monotonic response of the natural rubber latex modified fiber reinforced concrete beam, which exhibits improved ductility. Results are compared with the response of normal strength reinforced concrete beam. The flexural behaviour of polymer modified concrete has been investigated experimentally. Analytical modeling of the beam was carried out in user-friendly finite element software (ANSYS) to predict accurately the monotonic behaviour of beams which is considered to be the envelope of cyclic curve, thus helping the design process. A good agreement has been observed in the strains developed and the force-displacement behaviour, with the theoretical results.

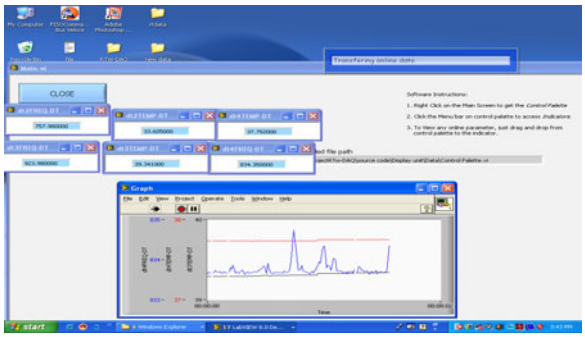
Fatigue crack growth studies on SA 516 Gr. 70 steel in air and sea water environments

A team of scientists from SERC has carried out fatigue crack growth (FCG) analysis of a plate subjected to constant amplitude pure membrane and bending stresses to predict the cycles required for an initial semi-elliptical crack to become a through wall crack. Semi-elliptical surface crack represents a more prototypical fatigue crack than the crack represented by standard specimens such as compact tension, C(T), middle tension, M(T) and eccentrically-loaded single edge crack tension, ESE (T) specimens. As yet there is no exact Stress Intensity Factor (SIF) solution for the problem of a semi-elliptical surface crack in a plate of finite dimensions. The empirical expressions developed by Newman and Raju are generally used. These expressions were used in evaluating the SIF range in the present analysis. Paris crack growth model has been adopted for determining the crack growth rates. C and m values for steels reported in the literature have been used for this purpose. An algorithm was developed and implemented in a spreadsheet. The spreadsheet gives the number of cycles to through thickness crack and crack growth curves in thickness and length directions.

Remote health monitoring scheme for civil engineering applications

Yet another notable development from SERC is remote health monitoring scheme for civil engineering structures. The technology provides simultaneous monitoring of a number of structures, which are geographically located at different places from a single monitoring station. The data can be acquired remotely from different type of sensors which are normally used for structural health monitoring in a single platform. Structural health of one prestressed concrete box girder span of a fly over bridge across dumper lines at Visakhaptnam has been monitored periodically. The bridge has been instrumented with vibrating wire strain gages for measurement of strains. Experiments were conducted to acquire and transmit data from

this bridge to the monitoring station at SERC via GSM network. The performance of the developed remote health monitoring scheme was further tested for long-term health monitoring of structures. Strain, acceleration and wind data was acquired continuously from a remotely located structure using GSM network. The software can be set to acquire data continuously for three days without any supervision. The response of the structure is monitored in real-time in various forms like, graphical display, numerical values etc. A new feature is added to automatically delete old files when storage memory in PXI at site is full.



Remote Data Acquisition from Field Structures

Durability and serviceability related provisions in IS 456 for design of reinforced concrete structural elements

Very few organizations, across the world, have the expertise in the areas of durability-based service life design and remaining life assessment of reinforced concrete structural members. SERC has proposed some recommendations, which improve upon the existing durability and serviceability related provisions for the design of reinforced concrete structural elements in IS 456. These recommendations include a revised classification of exposure conditions based on the major environmental parameters influencing the different deterioration mechanisms related to durability of reinforced concrete, separate values of minimum cover thickness for reinforced concrete slabs, explicit specification of service life for structures, equations for characteristic crackwidth for reinforced concrete flexural members under static and fatigue loading, and procedure for durability based service life design of reinforced concrete flexural members.

Progress made under Network Project

CSIR is operating three network projects in the area of housing and construction. The achievements during the year are presented below:

I. Developing new building construction materials and technologies

It is envisaged to develop low cost/ alternative building construction materials such as bricks, blocks, tiles, boards, cement/ concrete products, fibre reinforced composites, wood substitutes, coatings, sealants, paints, pigments etc. to replace/ supplement the conventional building materials which are in short supply in the country.

This network programme has three distinct yet related components; on which during the year, following could be achieved:

Fly ash utilization: A process has been developed for the use of fly ash, pond ash and mill reject coal of thermal power plant to prepare sintered lightweight building material aggregate pellet by down draft sintering. Another process using batch type pot grate sinter strand on 50 kg scale has been developed to optimize the mix proportion, solid fuel, pelletization and sintering conditions of fly ash, pond ash and mill reject coal. This type of sintered fly ash pellet is suitable for mixing with cement and sand in the manufacture of special heat insulation and lightweight concrete of M-20 and M-30 grade

for building construction application. Mill reject coal (low caloric value) and solid carbon bearing waste material are suitable to use as fuel in sintering of fly ash material and economical production of sintered aggregate. Other waste fines generating from metallurgical and chemical plants like red mud, sponge iron dust, gas cleaning and flue dust are useable in the process for production of building material aggregate. It is estimated that production of one ton of sintered fly ash pellet will consume about one ton of fly ash or pond ash. The production cost per ton of sintered fly ash (calculated on a 30t aggregate/day plant) is about Rs. 450. The process is ready for demonstration and know-how transfer for commercial use.

Interlocking bricks: In yet another significant development, interlocking bricks with provision of semi circular cavity on each of the sides of brick along length or along width were fabricated from alluvial clay mass of Roorkee through hand moulding process. The finished bricks have compressive strength above 75 kgf/cm^2 and water absorption below 17 percent.

Coating system: Physico-chemical properties of different coating systems based on epoxy-cardanol and epoxy resins have been determined. 120 days data shows that paints based on epoxy-cardanol are superior to that of unmodified epoxy based paints. The corrosion performance of the developed coating systems namely improved acrylic with conducting polyaniline pigment has been evaluated. This coating system was applied on the reinforcement bars and the corrosion resistant property of these coating systems has been evaluated by using various techniques.

II. Design analysis and health assessment of special structures including bridges

The project envisages to develop capabilities in health monitoring of structures which will help in integrity assessment, life management and life enhancement of structures, to understand the behaviour of new materials and retrofitting techniques and to prepare guidelines. During the period many significant achievements were made, notably; Software for advanced analysis of steel frames; preparation of design tables for structural steel members and connections as per draft IS 800; instrumentation at nine multi-storeyed buildings located in Delhi to obtain ambient vibration data; Passive energy dissipating devices based on visco-elastic materials and SMA were developed. The devices were tested both in element and structure levels; guidelines for seismic resistant design of framed structures using passive energy dissipating devices and design of prismatic structures under across wind loading have been developed.

III. New and improved road technologies

The project aims to provide the cutting edge technologies for developing the required road infrastructure with reference to construction materials for specific purposes, drainage systems, road management systems, information systems, and models for traffic measurement systems etc.

Since the objectives encompass a broad mandate, the achievements made are:

- A film has been produced incorporating road safety implication of using mobile phones while walking and driving. It is a 20 min film and is being shown at various forums to create road safety awareness.
- The kerb stones presently being used have visibility distance of less than 30 m. New design improves the distance to about 100 m. It would enhance road safety.
- The net-based software has been developed to facilitate the Driver

Licensing Authorities in issuing Driver License more effectively particularly due to effective knowledgebase questionnaire. The questionnaire has been demonstrated and administered over 1000 road users including experts from different organizations.

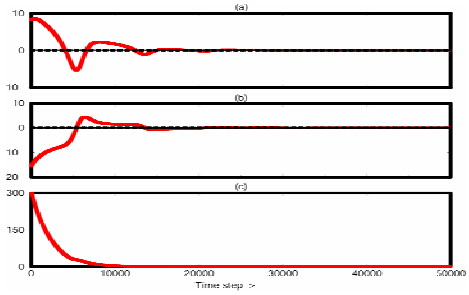
2.11 Information Dissemination & Products

Realising the exponential growth in the IT sector and knowledge based societies powering the current century, CSIR laboratories have evolved strategies to derive the benefits from its rich data and information base. Several initiatives towards that have been taken as under:

Scientific and Technological Achievements

Mutual chaotic synchronization for secure data communication

Chaotic synchronization is one of most amazing phenomenon in physics. CMMACS has proposed the concept of alternately switching mutual synchronization which possibly can be used for secure communication of information over unprotected channel. This phenomenon can be very well demonstrated on a three variable Lorenz System, where by making only a single state space variable public, two identical chaotic systems can be synchronized.



(a) & (b) Error in the undeclared state space variables between the sender and receiver.
(c) Monotonic decrease of Lyapunov function with time

This is proved by the existence of a Lyapunov function which monotonically decreases with time as shown in figure (c). Figures (a) and (b) show the convergence of the two secret state space variables between the two chaotic systems with time.

Inflow of papers, rejection rate, subscriber base and impact factor

Continuous efforts of NISCAIR towards improving the quality and subscriber base of the journals are yielding very good results. During the year, inflow of papers in all the journals increased substantially. At the same time, as a result of critical evaluation, the rejection rate of papers is found to be between 10 and 63%. There has been a steady increase in the subscriber base (~15% per annum) and many of the NISCAIR journals are covered by the Science Citation Index (SCI) and have an impact factor varying from 0.160 to 0.632.

Science popularization

NISCAIR publishes three well-circulated popular science magazines, *Science Reporter* (English monthly), *Vigyan Pragati* (Hindi monthly) and *Science ki Duniya* (Urdu quarterly) apart from a number of popular science books with a view to generate awareness about scientific developments and creating a scientific temper among the students and the common public. The institute also focuses on the coverage of R&D activities of CSIR labs through the newsletters '*CSIR News*' and '*CSIR Samachar*' (Hindi).

S&T for weaker sections and rural areas

NISTADS continued its thrust to support sustainable growth in rural areas, empower weaker sections through imparting knowledge and supporting poverty eradication; supporting artisans (primarily rural); grass-root innovation; and micro-entrepreneurship through policy advocacy.

Mapping knowledge trends and outcomes in S&T – Indian & Global

NISTADS has made a mapping of knowledge trends of Indian research output in science and technology in the form of research papers and patents including some leading public health and traditional medicine areas so as to provide policy directions to planners of national S&T.

History and philosophy of science

NISTADS has investigated social and environmental history with particular reference to nineteenth and early twentieth century to develop insights into foundations of current scientific and environmental endeavours in the country. The logical sciences, particularly ontological engineering, was investigated to draw inferences about its applications in future areas of computational sciences.

Progress made under Network projects

I. Comprehensive traditional knowledge digital library (TKDL)

The project envisages to collect and collate traditional knowledge that exists in public domain by creating a database on this knowledge in five international languages i.e. English, German, French, Spanish and Japanese and making these available to patent examiners throughout the world to prevent the grant of bad patents. The codified knowledge of the country will be converted into easily accessible and retrievable patent application in digital format.

Unani: Approximately 87,000 formulations have been identified, 86,000 formulations have been transcribed and 50,000 formulations scanned from the original texts. Approximately 1 lakh formulations from the identified texts are transcripted, scanned, verified and validated.

Ayurveda Phase II: So far, more than 50,000 formulations have been identified from the Ayurveda texts and checked for the duplicates. Transcription of 36,500 formulations has been completed. Approximately 65,000 formulations are transcripted, scanned, verified, and validated.

Siddha: Traditional Knowledge Resource Classification (TKRC) has been developed for Siddha System of Medicine. 10,000 formulations have been identified and 85000 formulations transcripted.

II. Consortium access to electronic journals

The project aims at providing CSIR S&T staff electronic access to S&T literature worldwide to strengthen the facilities for pooling, sharing and electronically accessing the CSIR information resources; and to nucleate the culture of electronic access with a view to catalysing the evolution of digital libraries.

Agreements were made with four new international publishers as a result of which all CSIR labs are now able to access 4200+ S&T journals vis-à-vis 20 to 200 print journals from 15 publishers. The post-agreement monitoring for all the above 15 publishers is being done regularly. Usage statistics of 15 publishers is being regularly organized and loaded on search interface and monitoring system gateway so that user labs may see it. Users' training and awareness programmes were organized in all CSIR labs during August to October, 2006. In all, 1000+ participants from the various CSIR labs were trained over a period of 45 man days. The average full text download has risen to 276500 from the average download of 200000 of the previous year. A format for walk-in-users, registration and feedback was prepared

and supplied to all nodal officers/Head of libraries to keep record of walk-in-users with request to their respective laboratories.

III. Mathematical Modelling and Computer Simulation

A central forecast engine (a hierarchical model assembly calibrated for different scale) along with specific components to be integrated in the forecast platform has been developed.

India's first dynamical platform for long-range (> 30 days) high-resolution (~ 50 km) forecast of monsoon rainfall has been developed. India's first and the only dynamical fog forecasting platform with an industrial interface, a cyclone forecast platform specially calibrated for the Indian seas with extensive validation are a few of the products from this effort.

2.12 Leather

Central Leather Research Institute is the largest leather institute in the world. Through inputs of S&T and extension activities it has been transforming the leather industry to a modern, vibrant, environment responsive industry. CSIR's pioneering inputs have been at all stages of the industry's activities starting from techniques for flaying of dead animals to storage of skins, using 'no' or 'less' salt, to appropriate time saving and low pollution tanning and processing techniques, 'low chrome' and 'no chrome' tanning chemicals, to modernization by computerization of net operations in tanning, to new techniques for generating value added specialty leathers, to computer aided designs for footwear, garments, and goods, fashion colour forecasting export certification and not the least of all in creating the human resources needed for the leather industry and the R&D in the sector. It had successfully mounted a pioneering Leather Technology Mission for the sustainable development of the Indian leather industry with vast grass-roots coverage. R&D programmes undertaken in network mode address the needs and priorities of the country

Scientific and Technological achievements

Fundamental microbiological and engineering aspects of chilling system as a method of preservation of hides/skins was taken up as a project by CLRI. The process conditions were standardised. A mobile chiller has been designed and field tested. Trials at commercial scale have also been conducted. The overall cost-benefit that this system offers to salt curing has been analyzed and considered as a viable option.

Low salt preservation

CLRI has standardized low salt chemical based system for preserving the skins for a significant span of time, Common salt as low as 5% was used along with MgO and the cured skins could be preserved for a period not less than 40 days. The quality of leathers is at par with that of the made from conventional salt curing. Commercial scale trials have been conducted.

Sole bonding by microwave heat activation

The bonding process in shoes generally takes place after the adhesive is activated with IR radiation followed by pressing and curing. Many a times, if temperature and time are not controlled properly, it leads to either weak bonding or material disintegration. To overcome this problem an alternative heat activation technique using domestic microwave oven, CLRI conducted trials at different energy (wattage) levels and time duration of activation. Study was conducted with commonly used upper and soling materials like TPR, PVC, PU and leather sole at 300 watts, 450, watts, 600 watts and 900 watts energy levels and times of activation of 10 seconds and 20 seconds. Microwave heat

activation as a method for sole bonding has been found to be effective at 20 seconds heat activation time.

New materials for therapeutic footwear applications

Many viscoelastic materials are used in shoes to replace the shock-absorbing and pressure distributing functions of natural fat pad beneath the foot that is lost due to some conditions such as diabetes, arthritis, age or overuse. CLRI has synthesized segmented polyether polyurethanes and converted into sheets by blending with commercially available polyester polyurethane. The cushioning and morphological properties of developed materials were studied for application in therapeutic footwear.

Near zero wastewater discharge in leather processing

A unique three step tanning methodology towards a near zero wastewater discharge leather processing has been developed by CLRI wherein cow hides are dehaired using enzyme based dehairing method employing standard enzymes. Hides were treated with α–amylase and water for a few hours in a drum. Alternatively, the hides were treated with 0.9% sodium hydroxide and water in a drum; duration of treatment is one day. A pickle basification free chrome tanning at pH 5.0 has been developed with and without masking. Speciation studies were carried out during the course of tanning in order to understand the mechanistic pathways associated in the novel processing method.

Progress made under Network Projects

I. Standardization of technologies for bioresources for and from leather

Under this project which envisages consolidating lead processes and products and developing technologies with commercial applications a few enzymes used as derailing agents have been tested and evaluated. Methods for production of animal feed from tannery wastes have been standardized.

II. Environment friendly leather processing

This project which aims to design, develop and disseminate through appropriate measures viable technologies environment friendly leather processing in India at near-zero environmental risk; and seeks to develop technologies for reducing the consumption of water in leather processing; to secure technology options for reducing the TDS level. A pilot scale plant for zero emission has been commissioned at CLRI. Phyto-remediation studies have established the need for cultivation of non-edible plants around tannery sites. A 100 litre/hr RO demonstration plant has been designed & developed and is ready for commercial scale trials. Prototype for treatment of tannery effluent using ceramic membrane has been developed and is ready for testing and evaluation studies. Prototype for nitrification/denitrification has been designed and developed. Eight collagen based products have been developed for application as health care systems. Innovative methodologies for solid waste management has been developed and demonstrated to industry.

2.13 Materials, Minerals, Metals & Manufacturing

CSIR laboratories have played a significant role in the development of special materials for aerospace, defence and sophisticated industrial sectors, viz. electronic materials such as luminescent phosphors for display, piezoelectric materials and devices, high purity alumina, conducting polymers, aerospace materials such as high density carbon-carbon composites, lead-free X-ray

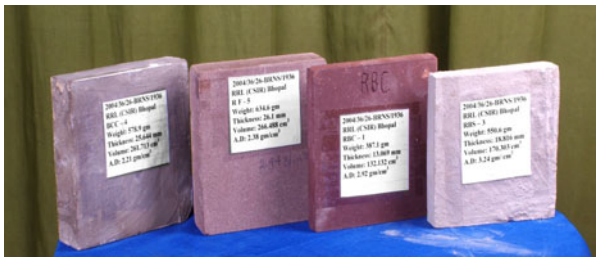
shielding materials, high performance industrial materials such as silicon carbide, silicon nitride bonded silicon carbide, silicon carbide whiskers; special glasses for optical fibres, infrared range finders and sol-gel techniques for glass coatings etc.; and superconducting materials.

Significant contributions have also been made in various aspects of mining operations, especially in coal mines (excluding heavy mining equipments), subsidence prediction and control enabling extraction of coal locked up in pillars and underneath surface structures and water bodies, for designing appropriate mine ventilation systems and for the mine disaster management in the country. CSIR is uniquely positioned in this area both through Network and Non-network projects. The progress achieved is presented in following paras:

Scientific & Technological achievements

Non-toxic (lead free) X-ray radiation shielding materials

For the first time in world, AMPRI has developed, under the sponsorship of BARC, Mumbai a novel process for making non toxic, highly effective shielding materials for attenuating X-ray and Gamma radiation, utilizing industrial wastes namely Red mud and Fly ash. The evaluation of shielding characteristics of the developed materials was carried out at Atomic Energy Research Board (AERB), Mumbai. AERB has computed half value thickness (HVT) and compared with conventional concrete and lead materials and suggested that shielding materials being developed can be used for the various shielding applications in diagnostic X-ray and CT installations.



Actual photographs of non-toxic shielding materials

Trace moisture analyser using sol-gel nanoporous thin film technology

Trace moisture analysers are used for on-line detection of trace moisture present in toxic/non-toxic industrial gases which are used in the nuclear metallurgy, defence, navigation, medicine and food industries. CGCRI has developed a sol-gel based technique which is very cheap compared to the available and conventional technology. It has been estimated that the cost of the CGCRI sensor is five times less than an imported sensor. The sensors are not only cheap; they are also pollution free and can be regenerated by cleaning with organic solvent after prolonged use. The sensor impedance can be matched easily with simple electronic circuit. In view of the low cost of the CGCRI sensors, P.H. Scientific (UK) has purchased six moisture sensors from CGCRI as part of evaluation to market this in UK.

CGCRI developed moisture sensors supplied to P.H. Scientific, UK

Corrugated steel strap (W–STRAP)

A development of considerable importance for mining industry has been the design and development of a corrugated steel strap (W-STRAP) which is commonly used in underground coal mines and tunnels. The new design would help fabricated roof bolts to enhance safer working. It also increases production in mines and will reduce the injuries and fatalities. Further, it can promote safe and more economic excavation at more depths. It is flexible and takes up the configuration of mine roof, which is not possible with steel channels. It is easy in transportation as it can be packed in bundles of 20 or 25 at a time. Pre–made holes in the W–strap suits the desired pattern of bolting. In case of emergency, extra bolt can be fixed in the roof after making hole into the roof through the pre–made holes of the strap. Its breaking strength is more than 20 tones and is cost effective compared to steel channel.

Emulsion based explosive and cord system for use in Blasting Gallery (BG) in underground coal mines

CMRI has developed for the first time an emulsion based explosive which has met the statutory requirements and considered suitable for use in BG panels. In order to achieve the required safety against inflammable atmosphere during trials for incendivity studies, flame retardant Polyethylene (FRP) tubes were used for the first time in designing permitted explosives in India. This system has a channel in the FRP tube for insertion of detonating cord for proper contact between the explosive and cord ensuring unfailing, safe and efficient blasting throughout the borehole.

Black box housing for automobiles

CMERI has developed a black box to house the entire circuitry including embedded software and hardware for automobiles. The housing is shockproof, fireproof, waterproof so that the assembly can absorb and withstand shock, impulses and possible escalation in temperature when a vehicle suffers from an accident. Centre for Development of Advanced Computing (CDAC) is developing, parallely, the entire system including sensors softwares and related hardware for data acquisition for an Automobile Black Box. After design and first prototype testing, 13 units were handed over to the CDAC for field applications.

Efficient filter press for vegetable oil of 40 & 90 l/hour

Using a filter press constitutes the quickest way of filtering expelled oil. Conventional filter presses available in the market are generally not optimized for efficient performance. CMERI has developed cast aluminium plates for filter presses to render the filtered oil more amenable to food standards. Use of aluminium alloy of 2014 grade reduces the total weight of the filter press from 14 kg to a mere 6 kg, while retaining, and improving upon the other operational parameters. Further to that the aluminium press was replaced by a polypropylene filter press which, while retaining all the major design features and advantages of the previous model, improves upon quality of the pressed oil.

National testing facility for general purpose rolling element bearings

Antifriction bearings are very important components of all machines and equipment as their malfunctioning affects very adversely the performance of the system. Therefore, understanding and evaluation of the life of rolling element bearings is of great concern. In response to this need, CMERI has established a National Test Facility for

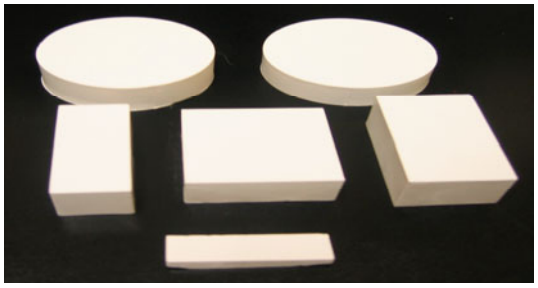
General Purpose Rolling Element Bearings at its premises in Durgapur in collaboration with Tata Bearings, a division of Tata Steel Limited. This facility, a unique one in the country, accommodates ten test rigs designed and developed at CMERI and can carry out accelerated life testing of bearings under controlled conditions. The load and lubricants are chosen in a manner to retain a minimum lubricant film thickness to avoid the metal-to-metal contact during the test run.

Graphite from calcined petroleum coke

IMMT has carried out, on 200gm scale, a series of experiments for the production of artificial graphite from calcined petroleum coke (cpc) powder employing catalysts such as B, Ti, Ni, Fe, Cu, Al, Mg, TiO_2, B_2O_3 etc. Results indicate 82 to 92% degree of graphitization and product yield of 90 to 94%. On the other hand, large-scale experiments on 1.5 kg basis, have shown physico-electrical properties very close to the commercially available pure graphite samples. The electrical power consumption per kilogram of graphite powder produced is around 5.0 Kwh. The typical properties of graphite produced using B, Ti and Ni catalysts by static bed plasma heat treatment are: density as 2.0 to 2.2 g/cc, electrical resistivity as 0.019 to 0.02 A Ωcm and d_{002} as 3.369 to 3.37 Å. Experiments were also conducted to produce graphite powders from cpc using above mentioned catalysts by inflight heating at different electrical power input levels and powder feed rates. The heat-treated end product showed density of 2.06 g/cc, electrical resistivity of 0.02 Ωcm and d_{002}=3.39Å. The electrical power consumption is also much lower (2.5 to 3.5 kwh/kg) than static plasma heating method.

Low toxicity environment friendly gel-casting system for industrial application

Conventionally, gel casting uses toxic acrylamide monomer for gelcasting process. IMMT has evaluated several eco-friendly monomers such as albumin, carrageenan, chitosan etc, for their possible utilization for gelation. The monomers were evaluated for gelling characteristics and kinetics of gelation using rheology measurement at increasing temperature ramps. After establishment of the gelation temperatures of each monomer, their yield points have been determined to assess the strength of the gels. Subsequently, actual gelcasting of ceramic systems such as alumina have been carried out using these monomers. Dense/porous bodies have been developed using Albumin. Dense bodies developed with chitosan showed 95-96% of theoretical density.



Dense products developed using environment friendly gel casting system

Electrolytic reduction of iron (III) present in phosphoric acid to iron (II)

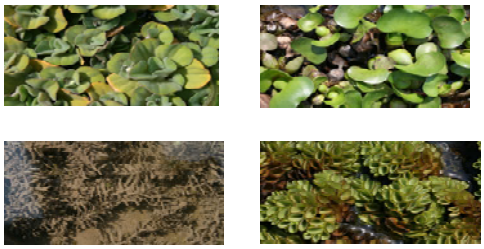
Using electrochemical route, scientists at IMMT have converted Iron (III) present in Merchant Grade Phosphoric Acid (MGPA) to iron (II). The electrochemical process provides better accuracy in control of electrochemical parameters and obviates any possible inclusion of impurities. An engineering package has been prepared for electrochemical reduction circuit for processing 5 l/h of MGPA along with details on equipment size and specifications, critical equipment design, safety aspects, equipment fabricator/manufacturer list etc. The unit, fabricated and tested at IMMT, has been installed at Heavy Water Plant (HWP), Talcher and is running successfully.

Demonstration unit

Phytoremediation studies of fly-ash using aromatic and aquatic plants

Studies on metal uptake and microbial population changes using aromatic grass of *palmarosa, jamarosa, lemongrass, citronella,* and *vertives* fly ash of Pradeep and NTPC origin were taken up at IMMT. For the remediation of ash pond water, four acquatic plants species were used. Studies reveal that the concentration of metal ions per gram of dry matter produced increased with increase in days of harvest. In case of aquatic plants, the highest total metal uptake was observed with *Eichhornia sp*. due to higher biomass yield. In aromatic grasses, the highest available metals like Co, Cu, Zn, Cd, Cr were taken up by *Citronella sp*. and Ni and Fe by lemongrass. The bacterial load from the rhizospheric region of lemongrass was maximum whereas the fungal load was maximum in case of palmarosa and jamarosa sp. In addition to this, phytoremediation and phytomining studies were also carried on nickel bearing chromite overburden of Sukinda (Orissa) and copper ore of Malanjkhand (MP) using the same aromatic grasses.

Experimental setup for phytoremediation of fly ash.



Aquatic plants used for phytoremediation of fly ash

Entrained flow biomass gasifier for thermal applications using powdery biomass

A team of scientists at IMMT has developed a 30kW$_e$ capacity entrained flow biomass gasifier for thermal application for efficient gasification of powdery biomass such as rice husks, saw dusts, coir dusts etc. L/D ratio (length to diameter of gasifier) of 10 has been adopted to improvise the mixed flow and plug flow reactor characteristics to ensure full suspension of powdery biomass in a vigorous radial mixing condition in the reactor and to achieve high intensity reaction and gasification. The gasifier-reactor attains a temperature of 900-1200^{O}C to take the advantages of the kinetics of the process and produce low tar and char formation. By maintaining a pre-estimated equivalent ratio of 0.27, temperature of the partial oxidation can be varied as per requirement. The endothermic steam induced reactions with a steam injection at a rate of 10-15 kg/hr coupled with the gasification reactions conserves the sensible process heat in the form of more hydrogen and carbon monoxide.

Prototype of entrained flow biomass gasifier system

New phosphor materials

New phosphor materials based on alkaline earth rare earth phosphates, which are likely to find practical applications in white light generation, Cathode Ray Tube (CRT) screens and other display devices have been developed at NIIST. Novel red and green emitting phosphors were synthesized by solid-state method. X-ray powder diffraction analysis confirmed the formation of xenotime type structure. Photoluminescence results showed that the phosphors can be efficiently excited by near-UV irradiation (396 nm/378 nm) and they give bright red and green emission with good chromaticity coordinates.

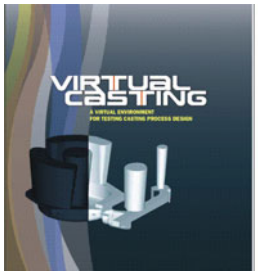
Production of synthetic rutile, metallic iron and high purity iron oxide

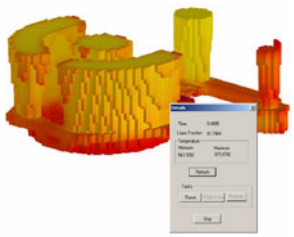
A newly designed and fabricated innovative cold plasma technique for the continuous melting of pre-reduced ilmenite has been found to result in separation of ilmenite into titania slag and metallic iron. This NIIST developed technique has been found to be better than a batch reactor in terms of high throughput and energy efficiently separation into titania slag and metallic iron to enable for continuous operation with very high throughput and energy efficiency than a batch reactor.

The process is simple and eco-friendly and results in separation of more than 90% of the iron in pre-reduced ilmenite. A valuable and salable by-product in the form of pig iron is also separated from the pre-reduced ilmenite. In addition to the metallic iron, the process also ensures a complete recovery of iron values from the leach liquor in the form of high purity iron oxide. The process flow-sheet is completely free from iron containing acidic effluents. The main product obtained, *synthetic rutile* is a suitable titanium feedstock for the chloride process of TiO_2 pigment production. The plasma reactor showed the power consumption of 1.2 KWh/kg and productivity (30 kg/hr). Synthetic rutile with more than 93% TiO_2 which ideally suited for chlorination was obtained in the pilot plant. Based on this technology, National Mineral Development Corporation is planning to establish a fully integrated pilot plant facility with a capacity of 1.5-2.0 tonnes /hr.

Making Computer simulation affordable to the Indian foundry

Virtual Casting, a software for simulation of casting solidification for the Indian market, seeks to help foundry men to create virtual environments to test out new designs and process innovations before actually implementing them on the shop floor. The software developed by NIIST makes it possible to shift the trials from the shop floor to the computer, saving time, effort, energy and material. As the casting industry in the country gears up to face the challenges of global competition, Virtual Casting attempts to make casting simulation useful and affordable to the small and medium scale foundry. It can be used, not only for industrial process design, but also in teaching and learning. Students of foundry technology can use the software as a virtual laboratory.





By experimenting with different process variables and seeing the impact on the final outcome, they can acquire great insight into the design process. It has been licensed for use by academic and industrial users.

Small capacity rubber sheet driers for marginal farmers

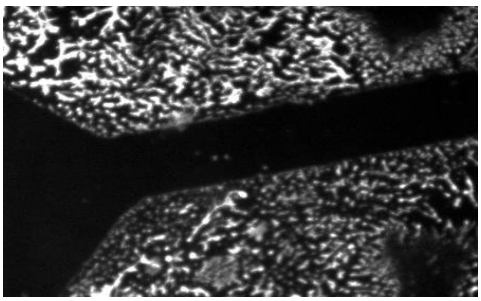
Technologists and engineer of NIIST have developed reverse flow natural convection driers, popularly known as RRLT-NC driers to help marginal farmers and cottage scale processors for rubber sheet drying. The drier has a capacity to handle 25-30 natural rubber latex sheets per batch, total hold up 60 rubber sheets and the drying time is 2 days. Fire wood /agricultural waste materials are used as fuel for the generation of hot air and smoke needed for curing the drier. The approximate cost of the drier is Rs. 13,000.

Glimpse of rubber sheet driver

Micropatterning of biological molecules

Patterning of biomolecules with micron and submicron resolution on to different solid surfaces is the key to the development of advanced biosensors, fundamental studies of cell biology and tissue engineering. NPL has used a simple technique based on microcontact printing of hexadecane thiol (HDT) and polyethylence glycol-thiol (PEG-thiol) to create pattern structure on gold-coated substrate exhibiting high hydrophobicity and high hydrophillicity, respectively. The hydrophobic regions strongly support the adsorption of proteins while the hydrophilic regions strongly resist the adsorption of proteins.

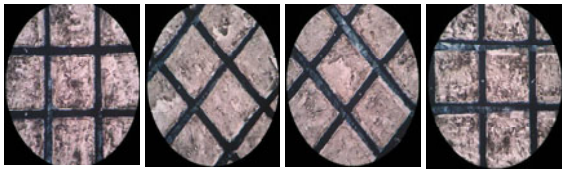
The pattern hydrophobic and hydrophilic regions have been further utilized to selectively deposit bovine serum albumin (BSA) tagged with Fluorescein isothiocyanate dyes. The figure shows the selective deposition of BSA-FITC conjugated molecules as seen under a fluorescence microscope. These experiments would form the basis to fabricate fluorescence based array biosensors for various biological applications.



80 µm

Micropatterning of alignment layers to produce pattern liquid crystal displays

The planar alignment of liquid crystals takes place only on the area having bilayer of amino propyl tri ethoxy silane & cinnamoyl moieties. Area patterned with Octyl-Triethoxy-silane (OTS) shows homeotropic alignment of liquid crystals. Alignment direction is governed by the polarization direction of the UV-light and can be varied locally. These two independent techniques have been combined to produce samples showing both homeotropic as well as planer alignment of liquid crystals in a single cell. This has given rise to the possibility of creating new storage liquid crystal displays. The technique may also be used to produce patterned liquid crystal displays. Both the alignments have been found to be stable with time and temperature.



Fluorescence micrographs of selectively deposited BSA_FITC conjugated molecules on HDT coated regionss

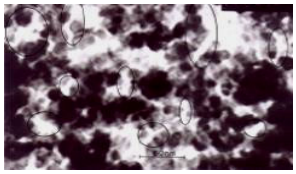
Self-cleaning coatings on glass substrates

An equipment which enable a user to obtain thin films of metal oxides by sol-gel dip coating technique developed by NPL is not only cheap as compared to the conventional coating equipment, but is simple to operate as adjustment of coating parameters can be done by simple knob operation. This equipment gives thin film coating on both sides of the substrate simultaneously. Uniform film thickness can be obtained on large area substrates up to 1 meter x 1 meter with this equipment. The coating solution is partially hydrolyzed metal alkoxide solution with catalyst. The composition of different constituents is adjusted in such a manner that the solution can be reused for coating up to six months if stored under sealed conditions. The solid films obtained from this solution are scratch proof and are stable under various environmental conditions.

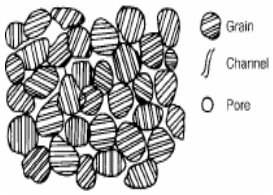
Simple glass windowpanes coated with films using the said technique blocks up to 30% of IR radiations and allows up to 80% of the visible part of the spectrum. These films absorb ultra-voilet radiations to excite electrons from the valence band to the conduction band. Valence band electrons helps in dissociating the organic matter which make the windowpane dirty while valence band holes helps adsorb O^{+1} groups on the surface thereby making the surface superhydrophillic. Both these properties are very important from architectural point of view. Such glass, used as windowpane reduces the heating and cooling cost of the building and its cleaning require little labour and less detergents which saves the cleaning costs.

Tungsten oxide films with a novel microstructure for fast switching smart windows

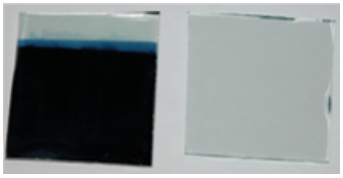
A group of researchers at NPL has used a potential driven self-assembly of sodium dodecyl sulfate/ tungsten oxide aggregates at the electrolyte-electrode interface followed by template extraction and annealing which results in mesoporous thin films of electrochromic tungsten oxide (WO_3). This is a first report on hybrid structures comprising nanoparticles and nanorods with a tetragonal crystalline phase of WO_3 with the measured lattice parameters. In addition to pentagonal voids characteristic of the tetragonal WO_3 phase at the lattice scale, open channels and pores of 5-10 nm in diameter lie between the nanoparticles, which cumulatively promote rapid charge transport through the film. This results in a large coloration efficiency and switching kinetics higher and faster than previously reported values for mesoporous WO_3 films. Repetitive cycling between the clear and blue states has no deleterious effect on the electrochromic performance of the film, which is suggestive of its potential as cathode in practical electrochromic windows.



Nanostructured thin film



Schematic of microstructure



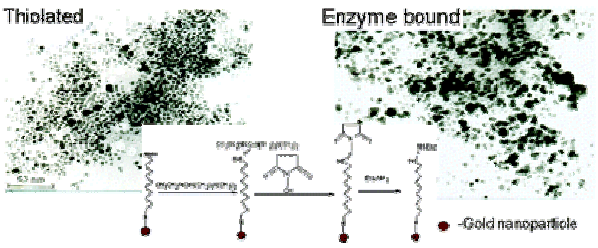
Coloured and bleached level

Thiolated gold nano particles for the enhancement of glucose oxidase activity

Biosensors have attracted much attention in recent times because of its potential applications in clinical diagnostics, environmental monitoring, pharmaceuticals, and food processing industries due to their

fast response and ease of operation. The stability of enzymes is crucial for the fabrication of biosensors. A number of techniques have been used for the immobilization of enzymes on different substrates to improve the enzymatic activity and stability. Nanostructure materials exhibit interesting properties such as a large surface-to-volume ratio, high surface reaction activity, high catalytic efficiency, and strong adsorption ability that make them potential candidate materials to play a catalytic role in the fabrication of a biosensor. Glucose oxidase (GO_x) has been covalently immobilized onto chemically synthesized thiolated gold nanoparticles (5-8 nm) via N-ethyl-N'-(3-dimethylaminopropyl) carbo-diimide (EDC) and N-hydroxysuccinimide (NHS) by a group of researchers at NPL.

The covalently immobilized GOx thiolated nanoparticles exhibit a response time of 30 s, a shelf life of more than 6 months, and improved tolerance to both pH and temperature.



Nanostructured thiolated and enzyme bound gold nano particles

Modelling of crack tip blunting using Finite Element method

A study which could help understand the blunting process in ductile material was carried out at NML, through finite element simulation (FEM) of standard fracture mechanics test specimen. From the load-displacement data generated by FEM, the crack tip opening displacement (CTOD) as well as J, an energy parameter of elastic plastic fracture mechanics, and Δa, the crack extension, accompanying the blunting process have been calculated. The effect of variation of material properties like Young's modulus, E, yield stress, σy and strain hardening parameter, n, on the shape and slope of the blunting line has been established. The numerically obtained blunting line has been validated using experimental results. The blunting line is mildly sensitive to the level of flow stress, with the inflection occurring at a lower flow stress and with reduced sharpness as the flow stress is increased. The blunting line slope is higher in low strength materials. The nature of the blunting line is greatly dependent with the work hardening capacity of the material, with the overall slope of the blunting line increases with increased hardening behaviour.

Beneficiation of iron ore from Joda (East) using Floatex Density Separator

In another study NML investigated the applicability of Floatex Density Separator (FDS) in removing alumina from iron ore fines (1.0 mm). Screw classifier feed containing 3.91% alumina has been used as feed to the FDS. Experiments according to a three-factor factorial design revealed that in single stage processing in FDS, a maximum of 72 % of the feed alumina could be removed. However, a loss in iron value is always associated with the removal of alumina. The recovery of iron under optimum condition was 61% in FDS. A final concentrate containing 1.66 % alumina could be achieved at a yield of about 57%.

Processing of waste printed circuit boards

Recovery of metal values from waste printed circuit boards (PCB) using physical beneficiation techniques using a combination of dry and wet processes involving desliming, tabling, flotation, multigravity separation,

electrodynamic and electrostatic separation was developed at NML. The process produces a rich concentrate with significantly high recoveries of metals from ground –0.5 mm PCB powder. A concentrate grade of over 93% total metal at a recovery of over 54% or a grade of 66% total metal at 95% recovery could be achieved. It gives a feasible alternative to purely dry processes that have inherent inefficiencies and which may not provide a cost-effective technology for processing electronic scrap. The flowsheet does not warrant any use of sophisticated machinery and relies on time-tested equipment with reasonably good efficiency. Precious metal content was found to be significant in the PCB powder and it calls for development of proper hydrometallurgy based technology to recover them.

Microwave assisted combustion synthesis of magnetic alloys: nanoparticles and nanowires

Electromagnetic radiation (microwave) do to play a role in the decomposition of organometallic complex, leading to a mechanistic pathway for bulk nano nickel wire bundle and sponge formation under ambient conditions. During the year NML has studied, what this role could be. Formation of wire is critically dependent on two factors: the mechanistic decomposition of complex under continuous exposure to microwave and extensive H- bonding in the molecule plays an important role in the decomposition mechanism. The formation of Ni wire is both thermodynamically and kinetically controlled in that, termination of exposure of microwaves on complex during decomposition results in an intermediate state (as Ni veins) prior to the formation of Ni wire. The shape and mass of Ni wire formation resembles heavily to the solid-state packing of organo metallic complex (bundle shape). On the other hand pulsed exposure to microwave results in finely divided, highly porous Ni sponge, a disrupted form of Ni wire. Ni wire exhibits a blocking temperature, TB> 300K with the saturation magnetic moment (Ms) of 55emu/g, could be suitable for high temperature applications in the field of memory storage. It would open a new approach in the nano materials synthesis, in bulk form.

In-situ generation of stabilized metal nanoparticles in interlamellar spacing and on mesoporous surface of Montmorillonite clay

Metal nanoparticles supported on microporous/mesoporous acidic oxide matrix are expected to behave very differently from bulk metals and are likely to act as bifunctional catalysts i.e. both as metal as well as acid function. Intercalation of metal acetate like $M(CH_3COO)_2$ (M= Ag, Ni, Co, Zn, Cu, etc.) into Na-montmorillonite produces intersalated product $M(CH_3COO)_2$-M11-Montmorillonite(I) which on reduction by polyols (ethylene glycol) method generates *in situ* the corresponding metal clusters in the form Mo-Montmorillonite(II) composite. NEIST has used incipient impregnation technique for deposition of $M(CH_3COO)_2$ on the micro/mesoporous clay support and subsequently dialyzed it to obtain composites with the salt loaded clay. The composites are characterized by X-ray diffraction. The supported metal salts were subjected to polyol reduction at ~195^oC. It has been observed that in some composites an ordered or channeled supported metal nanoparticles are formed. Similarly, mesoporous clay supported Auo-nanoparticle (8-16 mm size) are also synthesized and characterized by TEM.

Propensity for the air/water interface and ion pairing in magnesium acetate vs magnesium nitrate solutions

NEIST researchers during the period under report carried out molecular dynamics

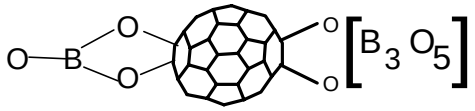
simulations in slab geometry and surface tension measurements for aqueous solutions of magnesium acetate and magnesium nitrate in various concentrations. The simulations reveal a strong affinity of acetate anions for the surface, while nitrate exhibits only a very weak surface propensity, and magnesium is per se strongly repelled from the air/water interface. CH_2COO^- also exhibits a much stronger tendency than NO_3- for ion pairing with Mg^2+ in the bulk and particularly in the interfacial layer. The different interfacial behaviour of the two anions is reflected by the opposite concentration dependence (beyond 0.5 M) of surface tension of the corresponding magnesium salts. Measurements, supported by simulations, show that the surface tension of $Mg(NO_3)_2$(aq) increases with concentration as for other inorganic salts. However, in the case of $Mg(OA_c)_2$(aq) the surface tension isotherm exhibits a turnover around 0.5 M, after which it starts to decrease, indicating a positive net solute excess in the interfacial layer at higher concentrations.

Progress made under Network Projects

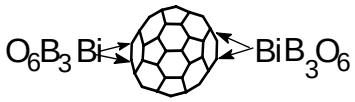
I. Custom tailored Special Materials

Advanced information and communication technology and ultra-fast processing devices are based on custom tailored special materials. It is envisaged to generate strong knowledgebase and up-to-date expertise by developing new generation materials like novel non-linear optical materials, bio-molecular electronic materials and functional nano-materials. The knowledgebase would be needed by both the Indian industries and also the strategic sectors to remain globally competitive in terms of technological and financial advantages.

Under this project Fullerene C_{60} and C_{70} doped monolithic bulk glasses for nonlinear applications were studied: Two novel high temperature chemical reactions of C60-fullerene respectively with Boron and Bismuth have been discovered in the course of development of high concentration of fullerene glass. The mechanism of chemical reactions has also been proposed. The structures of Boron and Bismuth complexes were also detected in the mass spectrum.



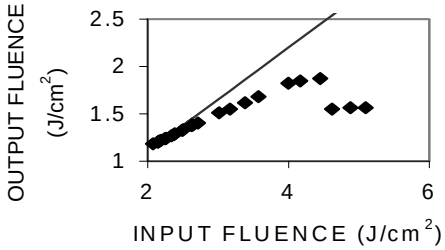
(a)



(b)

Detected structures (a) Boron complex ($C_{60}B_4O_{10}$, Mass =925) and (b) Bismuth complex ($C_{60}(BiB_3O_6)2$; Mass = 1397)

Nonlinear optical properties of the fullerene-glass composites reveal that the composites can limit the transmission of high intensity light. An optical-limiter transmits light when the latter is at low intensity but limits the transmission at its higher intensity, i.e. the efficiency of limiting of light transmission of such material, increases with the increase of intensity of the incident light and hence can function as a protector of laser sensor.



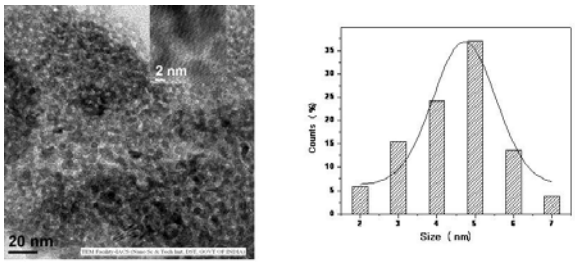
Variation of transmitted intensity with input intensity of 5 ns laser pulses at 532 nm through the glass. The straight line represents the extrapolated linear transmission.

Apart from showing the unique optical properties, these nano-composites are found

to have good electrical conductivity which may find applications in fabrication of conducting coatings. The processes of preparation and the products have been patented in India and abroad. The nanocomposites have been included in the CSA Materials Research data base with Metadex database, USA.

Developing nanoclusters of semiconductors like metal oxides, chalcogenides doped glassy films: is also an objective of this project, where in quantum confinement behaviour of indium tin oxide (ITO) nanoparticles was observed in the nanostructured sol-gel ITO films on glass. The excitonic transition due to confinement of electron-hole pair exhibited fluorescence behaviour which decays in the nano-second to pico-second range. The particle size distribution of the ITO nanoparticles was evaluated by transmission electron microscopy. Detailed analysis of the photoluminescence (PL) bands of nanostructured Mn (II) doped ITO revealed the exciton-phonon interaction.

The fluorescence life time measurement showed fast decay in the nanosecond to picosecond range which suggested that the exciton-phonon interaction did not change the PL life time.



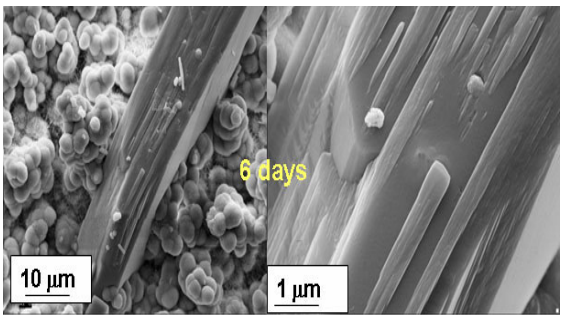
(a) *(b)*

(a) TEM image of ITO nano-particles and (b) particle size distribution

Ceramic cellular products based on biomorphic route

Silicon carbide (SiC) based materials have been developed through biomorphic route by replicating the cellular morphologies available in woods. Anisotropic structural feature of the Cellular or biomorphic Si/SiC ceramic composites may be employed to advantage in various micro-electronic applications such as design of a network of Si/SiC micro/nano-electrical heaters or power generators for micro-electronic circuitry which can be used in space technology, local communications, small batteries, refrigeration etc.

Novel synthetic route for Biomaterials and their applications was taken up being one of the objectives. The success of the use of metallic bio-implants depends on their bio-compatibility with the surrounding tissues inside the human body. One of the ways to achieve this is to give a Ca-hydroxiapatite coating of suitable morphology. A method for giving a coating of Ca-hydroxiapatite has been developed by using a biomimetic method in presence of protein. The coating has been characterized to find as to how the morphology and orientation of the coating are affected by the substrate. Detailed microstructural study has shown that the self assembly of protein molecules changed the morphology and orientation of the coatings.



Porous and solid HAp rods (~561 µm) developed on αAl_2O_3 by adapting bio-mimetic route

II. Capacity building for coastal placer mineral mining

In spite of having maximum enriched placer deposits, India continues to play a minor role in the marine mineral export compared to other dominating countries that have lesser potential than India. There is a high scope to improve the status of Indian placer export market through the development of indigenous mining and processing technology especially for buried placers and offshore resources. It is aimed to enhance the capability of country's technologies in the field of placer mining. The output of this work would put India as a global leader in this field, besides appreciable economic returns from the export potential. During the period, deposits of placer mineral available at Poompukar-Karaikal were characterised and pre-monsoon studies on profiling and sediment assessment including mineralogical studies and sediment budgeting through beach profiling for various season carried out. Likewise, about 75 samples were collected along West Bengal Coast of which profiles of 5 have been completed. 65 samples were processed mineralogically and 15 samples were analyzed through SEM. Micro-morphological features were studied. New set of exploration data upto 3 to 4 m depth at selected locations was created.

III. Developing capabilities in advanced manufacturing

The project aims to explore the applications of advanced manufacturing methods and to upgrade the indigenous expertise both in manufacturing automation and near net shape manufacturing to become self-reliant.

The network project has many ambitious goals, one of which, the facility for Virtual Prototyping and Immersive Visualization has been established. First indigenous AMR Prototype is ready for testing. In technology for tailored Stainless Steel Implants developed through the Investment Casting route has been transferred to M/s Manish Metals, Jamshedpur for manufacture of ADI crank shafts for automobiles.

IV. Biomineral processing for extraction of metal values from ores and concentrates and wastes

The project aims at bioleaching of low grade copper ores of Malanjkhand (0.3%Cu); Bioleaching of uranium (UCIL, 0.026% U); Strain improvement; Continuous down-stream processing for recovery of metal values (10 litres/hr capacity). During the year, after standardizing parameters for shake flask and column leaching of copper from lean ores of Malanjkhand, facilities for heap leaching have been established at IMMT, Bhubaneswar to study and demonstrate bioleaching process. Two bioheap leaching plants of 15 ton and 30 ton capacity have been installed for uninterrupted running. The leach liquor is being processed for continuous solvent extraction and electro winning to get high pure copper (99.98%).

V. Technology for engineering critical analysis

The project aims at development of technology for engineering critical analysis of the following components: pressure vessels and pipelines of the thermal and nuclear power plants, petrochemical and process industries; airframes and aeroengine components; infrastructural assets of the transportation industry: e.g. concrete and steel bridges, railway wheels and railway tracks; offshore structural components. During the period under review damage resistance of engineering materials was quantified. Experimental quantification of FCGR and fracture behaviour of 304LN SS was used for primary heat transport piping of nuclear power plants.

VI. Upgradation of SI Base units, National standards of measurement & creation of a network of Calibration and testing laboratories and preparation & dissemination of CRMs

The project has the mandate to upgrade Base Units and National Standards of measurements for: Mass, Luminous Intensity, Time; Chemical Metrology: Upgradation of apex level calibration facilities in the following parameters - Mass, AC Power & Energy, AC Voltage & Current, Length, Force, Temperature, Ultrasonics, Acoustics, Networking of calibration and test facilities existing in 12 CSIR laboratories for providing high quality testing and calibration facilities to users in all parts of the country at a reasonable cost and in a reasonable time; Preparation, certification and dissemination of certified reference material. The work carried out during the year has led to enhancement of capability in Luminous intensity, Temperature, Time, Current and Length. 21 CRMs were released and CRMs in pesticides, gas metals are being prepared.

III-B. CONSULTANCY DEVELOPMENT CENTRE (CDC)

1. INTRODUCTION

1.1 Background

The Consultancy Development Centre (CDC) came into being as a registered society in January 1986, and is functioning from its office at India Habitat Centre Complex since May 1994. The CDC was approved as an Autonomous institution of DSIR in December 2004. The Centre is managed and guided by a Governing Council headed by Secretary, DSIR. The Governing Council consists of representatives of consultancy organisations, R&D institutions, Government Departments, academic institutions, public sector units etc. CDC had a membership of 1331 as on 31-3-2007 representing various types of consultancy organisations and individuals experts associated with the consultancy. CDC has concentrated mainly on development of consulting skills and capabilities through providing data/information services on consultancy expertise in various sectors of operation, carrying out studies on consultancy promotion and development including export potential studies, training and capacity building programmes on consultancy needs and practices and strengthening of technological and managerial consultancy capabilities including promoting consultancy exports.

1.2 DSIR Support

DSIR provides financial support to CDC each year based on performance and review. During 2006-07, DSIR provided a financial support of Rs.60.00 lakhs. The Centre has its office at the India Habitat Centre complex and the space was procured through the grant-in-aid provided by the DSIR. Over the years CDC has developed the required infrastructure for collection, analysis and dissemination of consultancy related data, training and capacity building activities and for nurturing consultants and users of consultancy, thus resulting in better returns on investments through development of consultancy profession in the country. The Centre is equipped with Library facility for consultants with specialised collection on Consultancy Management.

1.3 Technical Consultancy Development Programme for Asia and Pacific (TCDPAP)

In order to enhance technological and managerial capabilities as well as the export capabilities of consultants, programmes have been organised for consultants at national and international levels, which have proved to be useful to promote consultancy business. CDC has been identified to be a nodal agency for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP), a programme promoted by the UN-ESCAP and supported by the DSIR. 13 countries in the Asia Pacific are the members of the TCDPAP. A General Council comprising representatives from each of the member countries guides this Programme. In addition, there is an Executive Committee to guide the implementation of the various programmes and policies laid down by the General Council. CDC has been nominated to function as the secretariat for TCDPAP upto 2008 by the General Council of TCDPAP.

2. ACTIVITIES OF CDC

2.1 Educational Programmes

a) MS Degree Programme in collaboration with BITS Pilani.

The Eleventh Batch of the MS Degree Programme in collaboration with BITS, Pilani Commenced with 55 students. Admissions to the third semester for the tenth batch were also conducted in parallel, in which the intake was 47 students.

b) Collaborative MBA Programme in consultancy Management with Indira Gandhi National Open University (IGNOU).

A proposal for collaborative MBA Programme in Consultancy Management was submitted to the Indira Gandhi National Open University (IGNOU) considering the need for developing educational programmes in the area of consultancy and outsourcing, which is an emerging area. The proposed programme covering certificate, PG diploma and degree programmes, shall be a new programme, different from the present MBA programme of IGNOU, through it may have some common courses. The distinguishing feature of these programmes would be a combination of distance, satellite, e-coaching, e-learning, contact and practice school pedagogies. The courses be developed in a modular concept so that the students could get Certificate or Diploma or Degree, depending upon the number of credits/courses completed. Details of courses and related modalities are being worked out to start the programme from July, 2008. The course content for the proposed course shall include latest developments and trends including state-of-the art in each module including the opportunities and prospects in emerging sectors like Technology Management, R&D Management in Pharmaceuticals, Biotechnology, etc. Details of courses have been finalized and the Centre shall sign a Memorandum of Understanding soon. Efforts are being made to launch the programme from July 2008.

2.2 Capacity Building Programmes

a) Four capacity building programmes on the following topics were conducted.

- Negotiation Skills for consultants and clients
- Workshop on Presentation Skills
- Workshop on Effective Business Communication
- Programmme on Project Management

All the above programmes were conducted in CDC and were well attended.

b) FIDIC Training Seminars

Two FIDIC Training Seminars on “Practical Management of Contract Clams and Resolution of Disputes” in collaboration with the Consulting Engineers Association of India (CEAI)were organized. The first programme was organized at Delhi from 21-22 September 2007 and the second programme was organized at Bangalore from 26-27 September 2007. Both the programmes were well attended.

2.3 Workshops and Seminars

Five Seminars/Workshops have been organized, the details of which are as follows:

a) “Leveraging Innovation for SME Competitiveness”: This DSIR sponsored Workshop was organized at Pune on 21 June 2007 in association with MITCON Ltd, a Technical Consultancy

Organization (TCO) and the Maratha Chamber of Commerce, Industries and Agriculture, Pune and was attended by 120 participants.

b) "Issues in Technology Management for Small and Medium Enterprises": This DSIR sponsored workshop was organized at Malaysia from 24-25 July 2007 under the Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) banner and in collaboration with the Professional Services Development Corporation (PSDC). The workshop was attended by about 200 participants from industry, R&D, academia, consulting and professional organizations in Malaysia.

c) Programme on Consultancy as a Career Option for Women on 26th October, 2007 at Chennai was organized by CDC Chennai Chapter.

d) Programme on Consultancy as a Career Option for Women on 26th October, 2007 at Hyderabad was organized by CDC Hyderabad Chapter.

2.4 Facilitation in Selection of Consultants

Facilitation in Selection of Consultants is a new activity initiated by CDC during this year.

One assignment of providing facilitation to NDMA in selection of Consultant for the World Bank funded National Cyclone Risk Mitigation Project has been obtained and the same has been successfully completed.

Two assignments – one from NDMA for Selection of Consultants for National Earthquake Risk Mitigation Project (NERMP) and Army Headquarters, Ministry of Defence for Selection of Consultant for modernization of Corps Zone Workshops" are under finalisation.

2.5 Projects/ Study Assignments

The following projects/study assignments were initiated during the year.

"Impact of Consultancy Services provided to Industry by Indian R&D Institutions" in the Aerospace and Automotive sectors under NSTMIS Scheme sponsored by Department of Science and Technology

The study will assess the impact of consultancy services provided by Indian R&D institutions and their experts to the Indian industry in the areas of aerospace and automotive sectors. The study will collect data – both financial basis (revenues earned) as well as technical basis (level and type of technologies provided) – on the Consultancy services provided by the Indian R&D institutions in aerospace and automotive sectors and analyze the data. The analysis will identify deficiencies /gaps in the services and suggest measures for further boosting up the consultancy services in the country. Such a study will provide a high value addition to the promotion of Indian consultancy services in the country as well as abroad and also help the Government in providing suitable policy initiatives in this field.

"Export potential of Consultancy Services in Latin American Countries- Brazil, Argentina, Colombia, Mexico" sponsored by Department of Scientific & Industrial Research (DSIR)

The assignment will identify the potential for export of consultancy services in key sectors in the countries of Brazil, Argentina, Colombia and Mexico. The identification

of gaps as well as evolving modalities to bridge the gap utilizing Indian consultancy expertise including joint ventures, business partnership to promote export of consultancy services will also be examined alongwith regulations, if any, on import of consulting services.

"Field based detailed study in South-East Asia (Vietnam) for enhancing Export of Engineering & Management services from India" sponsored by Department of Commerce

The objective of the study is to be carry out in-depth field based detailed study in South East Asia (country Vietnam) for the promotion of Management and Engineering Consultancy exports from India. This will involve identification of priority sectors as well as gaps and the strategies to bridge the gaps to enhance the export of consulting services. The scope also covers creation of a database of local consultants and consultancy organizations in Vietnam to build the strategic alliances.

"Environmental Consulting in India: available expertise, demand and constraints" sponsored by DSIR, Ministry of Science & Technology, Government of India

The study will assess the current status of environmental consulting in India with respect to consultancy organizations and individual consultants working in the area of environment and knowledge/ expertise available to undertake various aspects of environmental assessment with respect to present and future demands. The study will analyse the impact in terms of developed capabilities and identify potential areas to facilitate improvements in the protection and remediation of the environment in the country. The study will also identify the adequacy of laws, regulations, standards, EMPs and EARPs with respect to environmental protection and the recommendations of the study will suggest measures to overcome the demand in terms of capabilities to meet the requirements. The recommendations will also suggest a Road Map and an action plan to develop environmental consulting capabilities in the country.

"Consultancy Export Potential in 4 African Countries (Kenya, Uganda, Tanzania & Zambia)", sponsored by Department of Scientific & Industrial Research (DSIR)

The assignment will identify the priorities sectors/areas having potential for export of consultancy services in the countries of Kenya, Uganda, Tanzania & Zambia. It will also identify the consultancy opportunities in these sectors. The assignment will also address the competitiveness of Indian Consultants viz-a-viz major international players in these markets and what is the Market Access requirements. Recommend-ations of the study will help to evolve strategies to bridge the gaps with a view to increase export of consultancy services. As a part of the assignment database of local consultants/consultancy organizations will be proposed to strengthen strategic alliances with local partners.

2.6 Publications

Consultancy Business Opportunities

The daily email alert publication has been converted into a web enabled service. All the consulting opportunities – both national and international are uploaded on the website and members can access the required information using their password. The problem of blocking huge email space, which has been

the concern of several members, has been appropriately addressed through this mechanism. The scope of the information has also been enlarged to cover opportunities arising in various Central and State Governments, PSUs and other multilateral and bilateral agencies. Facility to access the information according to sectoral specialization, date wise and country specific options have been provided.

Newsletter Consultancy Vision

The quarterly newsletter 'Consultancy Vision' has been converted to an e-newsletter. Three issues of the same were brought out and circulated.

Journal – Consulting Ahead

The second issue of the Journal Consulting Ahead was brought out and disseminated widely.

2.7 Policy Issues

(a) Finalized the Document on Procedure for Selection of Consultants, Fee Structure or Consultancy Services and Standard Consultancy Contract Conditions. The draft document was circulated widely to nodal ministries and departments of the Government including PSUs and the comments obtained have been appropriately incorporated. The document brought out by Ministry of Finance on the subject was also referred and suitable provisions also have been incorporated. The document has been forwarded to DSIR for submission to the Committee of Secretaries.

(b) The Study on Development of a Model Accreditation/Grading/Rating System for Consultants in India has been completed and the draft report is ready.

3. PLAN FROM DECEMBER 2007 TO MARCH 2008

3.1 Education

Course material for the MS Degree Programme in collaboration with BITS, Pilani, for MBA Programme in collaboration with IGNOU shall be developed. E-learning technology will be developed/acquired and the course material will be converted to e-learning mode. With this the MS Programme in collaboration with BITS Pilani shall be expanded to Hyderabad, Bangalore and Chennai with effect from July, 2008 and also the Collaborative Programme with IGNOU shall be launched from July, 2008.

3.2 Projects/Studies Related to Consultancy

The on-going studies/projects will be completed. In addition the following three new studies will be initiated.

Study on Consultancy Capabilities and Opportunities in India

Objectives and Scope

The objective of the study is to bring out a report which provides comprehensive information on the present status of consultancy in various sectors, the nature and type of consulting assignments executed over the last decade, the capabilities and opportunities in the consultancy profession in India, in a holistic manner so that a Road Map can be evolved suggesting the measures to be taken to strengthen the Indian consultancy capabilities as well as promote export of Indian consultancy services.

The scope of the study will cover both technical and management consulting in sectors, which have led to economic development, and also prospective sectors in which there is growth and development taking place. The study would include all types of consultants – individuals and firms and also client organizations operating in the identified areas/sectors. The period of study will be last 10 years.

Study on Benchmarking Best Consulting Practices

Objectives and Scope

The objective of the study is to document the standard consulting practices – both in India and abroad which would help in promoting awareness amongst Indian Consultants to adopt standard and successful consulting practices as a business strategy, which would help in creating a competitive edge for their business.

The scope of the study will cover both technical and management consulting in sectors, which have led to economic development, and also prospective sectors in which there is growth and development taking place. The study would include all types of consultants – individuals and firms and also client organizations operating in the identified sectors. The period of study will be last 5 years and shall include six countries - two countries of Europe, two countries of North America and two countries of Asia Pacific. The countries will be finalized based on competence in consulting skills and nature of consulting assignments carried out using effective consulting tools and practices

Study on Status of Women Consultants in India

Objectives and Scope

a) Assess the number of women consultants operating in different sectors and sub sectors.

b) Assess the nature and types of services provided alongwith SWOT analysis

c) Identify key issues/ impediments restricting growth of women consultants

d) Recommend strategies for development of women consultants

e) Identify potential areas in consulting for women to opt for the same

f) Identify gaps in terms of capabilities vis-à-vis demand and suggest measures to overcome the gaps

g) To suggest a Road Map and an action plan to develop women consulting capabilities in the country

3.3 Developmental Activities

a) Tenth Annual Consultancy Congress on Outsourcing : Role of Consultants on 15-16 January, 2008 in association with Faculty of Management Studies.

To provide a platform for interaction between the various stakeholders with the aim to achieve a better understanding of the issues involved in client-consultant relationship for achieving organizational objectives of world class productivity through outsourcing of engineering and management services to consultants and experts.

b) Awareness programmes to women experts in various disciplines to possibilities of consultancy as a career option.

c) Annual awards for excellence in consultancy services to consultants/ consultancy organizations for rendering meritorious services.

d) Financial support towards participation in overseas seminars/skill upgradation programmes

3.4 Capacity Building Programmes

Programmes in following areas shall be organized.

- Consulting Methods and their effective use
- Development of internal consultants in organizations

- Contract Management, Project Management and Assignment Management
- Presentation and Negotiation Skills
- Use of Consulting Standards

3.5 TCDPAP Annual Conference from 22-25 April, 2008 in Seoul, Korea

The Conference shall be organised in association with Korea Engineering and Consulting Association (KENCA), Korea for which preparatory work will be done during the period.

4. REVENUE

CDC has earned revenue of Rs.332.72 lakhs during 2006-07 as against Rs.213.99 lakhs during 2005-06 from assignments, services rendered to various agencies, membership, etc.

IV. PUBLIC SECTOR ENTERPRISES

IV-A. NATIONAL RESEARCH DEVELOPMENT CORPORATION

1. INTRODUCTION

The National Research Development Corporation (NRDC) is a premier organisation, under the Department of Scientific & Industrial Research (DSIR), Ministry of Science & Technology, engaged in the development, promotion and commercialisation of the R&D results/ technologies emanating from Research Institutes/ Universities/ Industries, etc. The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. NRDC is a unique organisation because it is the only public enterprise wholly dedicated to transfer of technologies from R&D laboratories to industry. During the past five decades of its existence, the Corporation has developed strong links and network with various R&D organisations in the country as well as abroad for transfer of technologies. Its operations cover the entire spectrum of industrial technologies ranging from chemicals to metallurgy, mechanical engineering, electrical engineering, electronics, biotechnology and so on.

The Corporation continued to maintain its good overall performance in all areas of its operations during the year 2006-07. During the year, the Corporation's income from its principal source of revenue i.e. Lumpsum Premia and Royalty on the licensing of technologies to industry was Rs. 412.37 lakhs, as compared to Rs. 380.40 lakhs in the previous year.

2. PROFIT

A motivated strategic drive coupled with the dedication of officers and staff of the Corporation has resulted in an enhanced Surplus before Tax of Rs. 33.76 lakhs as compared to Rs. 26.05 lakhs in the previous year, an increase of 30 %. Efforts are being made to clean up the non-performing assets of the Corporation by writing off the outstanding loans and equity provided to the licensee companies for development and commercialisation of technologies. Accordingly, during the year 2006-07, the Corporation had written off such loans and equity amounting to Rs. 54.23 lakhs.

The Gross Income of the Corporation from all sources, including premia and royalties, but excluding Grants-in-Aid, was Rs. 534.91 lakhs as compared to Rs. 501.59 lakhs in the previous year. The Department of Public Enterprises has given an 'Excellent' rating to your Corporation for its MOU performance during last year (2005-2006), an improvement over its rating of 'Good' in the previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

The Corporation continued its efforts to identify new technology resources by nurturing long-term relationships with R&D laboratories, industries, universities, IITs, and individual inventors. As a result, 39 new processes were assigned to the Corporation for commercialisation as compared to 30 processes during the previous year. Some of the commercially important processes assigned to the Corporation during the year are:

- Removal of Arsenic and Iron from Ground water
- Formulation for Fruit and Vegetable (apple, plum, orange, sweet lime, grape, lemon, tomato, brinjal, capsicum) Coatings and Application Protocols
- UV Absorbent for Skin Care Formulations
- A Novel Organic Seed Protectant of Plant Origin
- New Anti-Cancer Formulation based on Methyl Glyoxal
- Multipurpose Design Cutting Machine
- Process for Preparation of Probiotic Dahi
- Synthetic Milk Detection Kit
- Cholesterol Biosensor
- XYLANASE – Enzyme for Paper and Pulp Industry
- Process for Production of Red Palmolein and Zero Shortening
- Process for Physical Refining of Rice Bran Oil

4. MAJOR TECHNOLOGIES LICENSED

Due to the aggressive marketing of technologies, the Corporation signed 44 licence agreements during the year as compared to 39 in the previous year. Some of the major technologies licensed by the Corporation during the year are:

- Seri Gold - A Powerful General Disinfectant for Sericulture used for the Disinfection of Rearing Houses and Rearing Equipments
- Mulberry Leaf Health Drink
- Pithplus
- Magnesium Silver Chloride Seawater Activated Battery
- Bio-Larvicide
- Porus Conducting Carbon Paper
- Night Time Highway Systems for Automobiles (Auto Dipper)

5. ROYALTY AGREEMENTS SIGNED BY THE CORPORATION FOR PROJECTS SUPPORTED BY DEPARTMENT OF SCIENTIFIC & INDUSTRIAL RESEARCH (DSIR)

DSIR has been supporting technology development projects under its "Technology Development and Demonstration Programme" (earlier known as Programme Aimed at Technological Self Reliance) involving industry, research institutes and consultants. The Corporation has been entrusted to manage all matters connected with the intellectual property rights generated in these projects, as also to collect the royalty revenues accruing from the utilisation of the technology by the collaborating Company and also from third party licensing. The following major projects were undertaken during the year:

- Development of Piezoelectrically Actuated Micro Mechanical Switches of RF Application
- Design and Development of 6 DoF Electrical Motion Platform
- Identification, Development & Utilization of Natural Dyes from Forest Plants, Weeds and Agricultural Waste
- Demonstration of CRRI Technologies for Construction of 750 m Demonstration Stretch Road Using Marble Slurry Dust in Rajasthan
- Nano Labelled DNA / RNA Compounds
- Microbial Production of Arachidonic Acid

6. INTELLECTUAL PROPERTY RIGHTS (IPR) CONSULTANCY SERVICES

During the year 2006-07, the Corporation in its pursuit to protect inventions and technologies has filed 86 patent applications in India in various sectors of technologies for individual inventors, universities, R & D institutes and industries. During the year six Indian patents and three foreign patents have been granted.

The Corporation has been catering to requests received from various R&D institutes and industries for conducting state-of-the art searches, the result of which is being utilized in many cases for submitting research projects or even initiating research projects at university level so that the project subject coverage should be novel and not a mere repetition of R&D work already done. This is in addition to the usage of these search results for filing patent application in India and abroad. During this financial year, 35 state-of-the art searches have been conducted on diverse fields, utilizing the databases like Dialog and STN.

Collaborative efforts of the Corporation with Patent Offices, Universities, R & D Institutes, State Science & Technology Councils, etc have gained momentum and resulted in enhanced demand for organizing IPR Awareness and Training Programs. During the year, the Corporation has collaborated with various organizations and organized the 23 seminars and training programs in different parts of the country.

All these seminars, workshops and training programs were widely appreciated and rated excellent.

The Corporation has reached out to various R&D institutions and universities for educating intellectuals about the importance of protection of IP assets in the knowledge era by delivering lectures on focal areas of importance such as Patenting System in India, The Rationale of Protection of Geographical Indications of Goods, State-of-the art Searches, Trade Marks Registration Procedure, IP Valuation and Management, Agricultural Biotechnology and many more.

7. PRIZE AWARD

To promote and encourage the spirit of inventiveness amongst scientists, workers, students and inventors, the Corporation continued its programme of giving awards upto Rs.2.00 lakhs for the development of novel processes, products, and inventions. During the year, the Corporation announced cash awards amounting to Rs.5.00 lakhs for the following inventions:

- Development & Commercialization of Novel Process Technology for Removal of H2S and Mercaptans from LPG through Continuous Film Contactor (CFC)
- Full Garlic Peeling Machine
- Vivek Thresher for Mandua (Finger Millet)/ Madira (Barnyard Mill)
- Membrance Oxygenator, a Medical Device for Cardiac Surgery
- Guard for Protecting Padlock and the Strip

The Corporation also announced one WIPO Gold Medal for the best invention of the year "Development & Commercialization of Novel Process Technology for Removal of H2S and Mercaptans from LPG Through Continuous film Contactor (CFC)" to Dr. R.P.Verma and Associates.

8. DEVELOPMENT & PROMOTION OF RURAL & HOUSEHOLD TECHNOLOGY

The Corporation continued to pursue its program of Development and Promotion of Rural & Household Technology to use modern science and technology for the following:-

The methodology adopted by the Corporation is to demonstrate the utility of its rural technologies and ensure their faster dissemination by setting up Rural Technology Demonstration cum Training (RTDT) Centres in collaboration with voluntary agencies in various regions of the country. Pursuant to following this approach, the Corporation has strengthened 7 Centres at Faridabad (Haryana), Tirupathi (AP), Ghazipur (UP), Chickballapur (Karnataka), Mandhar (J&K), Jagdishpur (Jharkhand) and Kundrakudi (Tamil Nadu) with new emerging technologies as per the need of the specific area. Training Programmes on live stock development, blue green algae, soya and bio-fuel processing, coir retting and electronics design up-gradation were conducted in collaboration with local NGOs. Further, the Corporation has participated in various exhibitions, rural fairs and Pashu Kisan Melas.

9. EXHIBITIONS AND PUBLICITY

Participation in exhibitions, seminars, workshops and entrepreneurship development programmes are of vital importance for the creation of awareness about the role of the Corporation in technology transfer. With this end in view, the Corporation participated in exhibitions, seminars and get- togethers in India and abroad organised by various agencies as detailed below:

- Hannover Fair, Germany
  24-28th April, 2006
- 7th SAARC Trade Fair, Karachi Pakistan;
  16-18th June, 2006
- 9th Rwanda International Trade Fair,
  Rwanda, Kigali; 25th Aug-4th Sept., 2006
- Made in India Show, China
  8-11 Sept. 2006
- Minerals, Metals, Metallurgy & Materials,
  New Delhi; 11-14 Sept. 2006
- CSIR Rural Exhibition, Dhanbad,
  Jharkhand; 26-31Oct., 2006
- Pashu Kisan Mela, Bareilly
  28-30 Oct. 2006
- Technology Summit, New Delhi
  6-7 Nov. 2006
- 10th India Tech 06, India International
  Trade Fair, New Delhi; 14-27 Nov. 2006
- Dairy Expo, Chandigarh; 1-4 Dec. 2006
- Mind to Market, New Delhi
  4-6 Dec.2006
- Science Congress, Chidambaram
  3-7 Jan 2007
- Consultancy Congress, New Delhi
  15-16 Jan. 2007
- Mint To Mint, Kanyakumari; 18 Jan. 2007
- Pharm Expo 2007, Mumbai
  6-10 Feb. 2007
- Technovation, New Delhi
  13-16 Feb.2007
- Vendor Dev. Programme Cum Indus.
  Exhibition, Hubli; 22-26 Feb. 2007
- Commercialisation of Chemical
  Technologies, Mumbai
  16-17 March.2007

10. PUBLICATIONS

Dissemination of information on new processes to industry, entrepreneurs and the

general public plays an important role in the process of technology transfer. One of the means of doing so is through publications of various types. During the year, the Corporation continued to bring out the regular publications *Awishkar* (Monthly in Hindi) and *Invention Intelligence* (Bi-monthly in English). Apart from this, during the year, the Corporation has also brought out special publications viz. NRDC-Your Technology Partner, NRDC Meritorious Invention Awards and a Folder on Technology Trade Facilitation Centre being operated by the Corporation.

11. MARKET SURVEYS

Detailed market information makes the technology package more attractive to entrepreneurs. With this end in view, the Corporation commissioned professional market surveys in respect of the following technologies:

- Probiotic Food
- Anti Reflective Coating on Circular Glass Lens
- Anti Glare Coatings on Sheet Glass
- Auto Dipper
- Porus Carbon Paper for Fuel Cell Applications
- Low Cholesterol Ghee
- Shelf Life Extenders for Fruits and Vegetables

12. TECHNOLOGY AND PROJECT EXPORT

Our technologies are appropriate to the needs of many other developing countries. The Corporation, therefore, considers it an important part of its charter to seek out and seize opportunities in those countries for technology and project exports. The Corporation's concerted and energetic efforts to export Indian Technologies have resulted in excellent contacts in Africa and signing of several Agreements. Strategic alliances have been made with local consultants in the countries of potential business to secure business in those countries. A few such agreements are listed below:

- Agreement for setting up of Demonstration Centre for Small & Medium Machines with Social fund for Development, Cairo, Egypt
- Representative Agreements with (a) Rahimafrooz Renewable Energy Ltd., Dhaka, Bangladesh, (b) Bangladesh Development Resource Group. Dhaka, Bangladesh, (c) Millis Consult, Ethiopia, (d) Rwanda Pvt. Sector Federation, Rwanda
- Cooperation Agreement with Serviva Gmbh, Germany
- Agreement for transfer of technologies with Agricultural, Industrial Finance Group of Democratic Republic of Congo

During the year several delegations from other developing countries were received and the Corporation was able to generate interest of major international companies in indigenous technologies.

13. FOREIGN EXCHANGE EARNINGS

The foreign exchange earnings of the Corporation amounted to Rs. 18.47 lakhs in 2006-07 as compared to Rs. 0.38 lakh during the previous year.

14. KNOWLEDGE MANAGEMENT SYSTEM (KMS) FOR TECHNOLOGY PROMOTION

The commercialization of unproven lab scale indigenous technologies involves high risk

and therefore, the entrepreneurs are generally not keen on endeavouring a venture based on such technology. In order to overcome this difficulty, the Corporation has introduced the Knowledge Management System (KMS) in 2004-05. It is a self-propelled mechanism for systematic evaluation of the technologies, by a team of experts for value addition to the extent possible for making a complete technology package for setting up commercial plant and the chances of its success become high. The Expert Panels also suggest strategies for marketing of technologies and sources for scouting of new technologies.

15. TECHNOLOGY DEVELOPMENT PROGRAMME FOR PRIORITY PROJECTS

The Corporation has been promoting and financing in collaboration with industry and R&D institutes, technology development projects for further development, setting up pilot, semi- commercial or demonstration plants. The progress on the major technology development projects is given below:

In-vivo evaluation and further development work on Targeted Gene Delivery System

The know-how for virosome based Targeted Gene Delivery System, a platform technology, was developed by University of Delhi. It is highly target (liver cell) specific and has a strong potential to develop various therapeutics for a number of diseases originating from liver cells- Hepatitis, Liver cancer, Hemophilia, Malaria, etc. This process know-how has a very good opportunity for licensing in other countries, provided *in-vivo* data is available on the process.

Optimization of New Anti-Cancer Formulation using Methylglyoxal as a lead compound

An anti-cancer formulation using Methylglyoxal as a lead compound for the treatment of cancer has been developed by Indian Association for the Cultivation of Science, Kolkata. The formulation has broad applications and it can cover many aspects using imino acid conjugates of methylgyoxal. Methylgyoxal acts selectively against malignant cells. Its effects can be significantly augmented with natural compounds, ascorbic acid and other vitamins. Methylgyoxal is a potent anti-cancer agent through both *in-vitro* and *in-vivo* routes. The work is going on satisfactorily and results are expected during the current financial year 2007-08.

16. NEW INITIATIVES TAKEN DURING THE YEAR

All out efforts are being made to expand the area of operations of the Corporation. Further, services of a few Experts and Consultants are being utilised to avail higher degree of technical expertise for evaluation and value addition of various technologies. Some of the initiatives undertaken by the Corporation during the year are:

Basic Engineering Design Package (BEDP)

During the financial year 2006-07, the Corporation has initiated developing Basic Engineering Design Packages (BEDP) for up-scaling the lab scale technologies; it will add immense value to technologies. Initially, the Corporation has been availing the services of consultants for developing BEDP; simultaneously, the Corporation has been developing skill and knowledge amongst its own officers on the software used for development of BEDP.

Angel Funding by way of Equity

In order to promote fruitful utilization of the results of research work carried out in the country and to enlarge the technological entrepreneurial base in the country, the Corporation with the support from the

Administrative Ministry initiated a new activity, viz. Angel Funding for financing by way of equity, the small and medium size companies.

The financial presence of the Corporation in the venture not only lends credibility to the project but also instills confidence in the promoters, industry and other financial institutions in the prospects of the technology.

During the year 2006-07, the Corporation subscribed Rs. 30 lakhs in the share capital of M/s Dess Computer, Mumbai a software product based company. The Corporation proposes to expand this activity in the coming years.

17. TECHNOLOGY TRADE FACILITATION CENTRE (TTFC)

The Corporation under the support from the Administrative Ministry has been successfully running the TTFC at the Corporation's registered office, to facilitate the exports of technology intensive products, technologies, services and projects. TTFC is truly helping SMEs to identify potential importers, in the international market for their products. During the year 2006-07, several foreign dignitaries and business delegations visited the Centre and a large number of enquiries have been generated from them. The Corporation along with its TTFC supported companies participated in various international fairs. Enquiries received during the fairs are at various stages of maturity.

18. HUMAN RESOURCE

The real asset of any company is its human resource. The total manpower of the Corporation as on 31st March 2007 was 98 viz. (Group A-29, Group B-37, Group C-24 and Group D-8). The employee-management relationship was cordial throughout the year.

During the year under review, there were no employees receiving remuneration of or in excess of Rs. 24 lakhs per annum or Rs.2,00,000 per month, requiring disclosure as per the Provisions of Section 217(2A) read with the Companies (Particulars of Employees) Rules 1975.

19. HUMAN RESOURCE DEVELOPMENT

Training and development at all levels of employees was given due priority by the Corporation to increase effectiveness. Special emphasis was given to organisation building and shaping right attitudes, team building and work culture, besides preparing employees to understand the trends in fast changing technology and switching over to latest technology for achieving higher results in productivity and profitability. During the year 34 executives and 4 staff of the Corporation were deputed to various training programmes to further develop their skill in various areas of management, communication, vigilance and advancement of technology.

The thrust for better utilisation of Human Resource and improvement in work practice continued during the year.

20. TECHNOLOGY ABSORPTION, ADAPTATION AND INNOVATION

While a major objective of the corporation is the development and commercialisation of indigenous technology, the Corporation itself does not carry out any R&D. However, it promotes and finances R&D on a selective basis in both laboratories and industry. Hence the requirement to furnish information in respect of Technology Absorption, Adaptation and Innovation under Rule 2(B) of Companies (Disclosure of Particulars in the Report of Board of Directors) Rules, 1988, is not applicable to the Corporation.

21. IMPLEMENTATION OF OFFICIAL LANGUAGE

The Corporation continued to make efforts to fulfil the targets prescribed by Govt. of India in the Official Language Act and Rules framed there in with regard to increase the use of Hindi Rajbhasha in office during the year 2006-07. Employees were motivated to use their working knowledge of Hindi in day-to-day official work. All the Standard Forms, Files, etc are bilingual. Significant progress has been made in the field of correspondence, noting and drafting in Hindi. All Hindi letters are being replied in Hindi only. The Annual Report of the Corporation is being published in diglot form in both Hindi & English since 1986-87. The Corporation also publishes a popular Science & Technology monthly magazine in Hindi, entitled 'Awishkar'. To popularise the use of Hindi, the Corporation organised a Hindi Workshop. During the workshop, information was given regarding Official Language Act, Rules, and drafting & noting. To enrich Hindi vocabulary of the employees of the Corporation as well as visitors, an English word with its Hindi meaning is written daily on a writing board as 'Today's word' at the reception of the Corporation.


COCOLAWN
LAWN


Briquetting of Agricultural Waste
Biodiesel from Jatropha


AIRWIN

IV-B. CENTRAL ELECTRONICS LIMITED

1. INTRODUCTION

Central Electronics Limited continues to hold top position among other Public Sector Undertakings particularly in the field of SPV. CEL focuses on following activities:

a) To be a global player and a major domestic player in the area of Solar Photovoltaic Cells, Modules and Systems by upgrading the capacity from 2 MW to 10 MW and by productionization of higher wattage modules up to 210 Watts with special emphasis on use of thinner wafers (about 240 microns) to become price competitive in domestic and international market.

b) To maintain leadership in the development, supply and commissioning of signalling, safety equipment to Indian Railways to meet their existing and emerging modernization needs.

c) Expand capacity and product profile using new technology and sub-assemblies for the supply of strategic components such as PCM to DRDO Labs. Ministry of Defence, Product portfolio in respect of PZT and Dielectric material for newer and newer applications using powder composition for Naval applications and consumer items like Mobile phones etc.

2. PERFORMANCE IN 2006-07

2.1 Operating Results

Production, Sales and Profit/Loss achieved during the year as compared to the previous year are given below.

(Rs. in crores)

	2006-07	2005-06
Production	139.26	102.74
Sales	133.93	108.80
Operating profit	11.48	5.90
Net Profit carried forward to Balance Sheet	2.85	12.43

2.2 Exports

During the year, total exports of the company were Rs.16.49 Crores as against Rs.23.98 Crores in previous year.

2.3 Major achievements of CEL during 2006-07

- Placed orders for major capital equipment projected in the Project proposal for upgradation and upscaling of SPV operations to 10 MWp per annum.
- Completed infrastructure facilities, wherever necessary, for the implementation of the project for capacity enhancement.
- Completed civil & electrical works for new production line and facilities to be installed for increased capacity in cell process and module areas.
- Completed implementation of the project for up gradation and up scaling of Solar Photovoltaic operations to 10 MWp per annum by the end of 4^{th} quarter.
- Completed the development of Multi Section Digital Axle Counter (MSDAC).
- Procured trial orders for Multi section Digital Axle Counter after obtaining RDSO approval and successful field trials.

- Inducted Train Actuating Warning System (TAWS) at Level Crossing of Indian Railways.
- Followed up with Railways for developmental orders for indigenous development of SSI.
- Offered IFF system to BEL for inspection.
- Completed the development of ASIC-3 and obtained trial quantity to complete development of Hybrid Driver for X-band simultaneously.
- Developed technology of PZT 8 material for future technologies in Sonar area and Dielectric material suitable for Patch Antenna used in Cellular/Mobile phones with an aim to expand product portfolio by adding one or two items for high volume applications.

3. PERFORMANCE IN 2007-08

3.1 Operating Results

(Rs. in crores)

	2007-08 (31 Oct)	2006-07 (31 Oct)
Production	58.75	64.06
Sales	51.81	58.75
Net profit/loss	(-) 3.87	0.93

3.2 Exports

During 2007-08, exports have been Rs.8.36 Crores (till October), as against Rs.7.51 Crores in 2006-07 (till October).

3.3 Other Highlights of 2007-08

- Implementation of upscaling and enhancing the production facility of SPV Cells and Modules from 2 to 10 MWp. About 6 MW production is being targeted.
- Standardized the process for using 6" wafers (Multi Crystalline and mono crystalline) to produce 200/210 Watt modules.
- Processing of 240-micron wafers in commercial production of SPV.
- Installed and commissioned 200 KWp Solar PV Power Plant (biggest in India) at Om Shanti Retreat Centre, near Manesar, Haryana.
- Augmented production capacity for Digital Axle Counter installing Automated Test Equipment (ATE) for production testing, to cater for substantially increased demand expected in coming years.
- Supplied and installed 2 Nos. of multi section digital Axle Counters for extended field trial leading to procurement of bulk order from Railways.
- Designed and Developed 3D/4D version of digital Axle counter suitable for Point Zones and offered the same to RDSO for approval.
- Successful development of Digital Axle Counter conforming to CENELEC SIL-4.
- Taken up design and know-how from RDSO for universal fail-safe block equipment and submited proto type module to RDSO for their approval.
- Initiated development and production of Train Protection and Warning System (TPAWS) jointly with other agencies for induction in Indian Railways.
- Completed the supply of X band PCM's order of BEL & LRDE and booked fresh orders for 7,000 Nos. of PCMs.
- Initiated necessary action for augmentation of production capacity of PCMs to cater for large projected demand of PCMs in coming years.

- Designed and developed heat fuse 551 and submitted the samples with a view to meet the demand of defence after necessary MOU between CEL and OFK.

4. FUTURE STRATEGY

- To be a global player and a major domestic player in the area of Solar Photovoltaic Cells, Modules and Systems by up-grading the capacity up to 25 MW and by productionization of higher wattage modules up to 210 watts using thinner (220 micron) wafers.
- Augment production capacity for Digital Axle Counters installing Automated Test Equipment (ATE) for production testing, to cater for substantially increased demand expected in coming years.
- To procure orders for Multi Section Digital Axle Counters and Train Approach Warning Devices.
- Development of Train Protection & Warning Devices.
- To initiate R&D of Transit Receiver (TR) Modules in silicon BICMOS Technology.
- To diversify in the areas like Public Area Security Systems and Communications, which has huge market potential due to increased threat perceptions of terrorists.

5. FOREIGN EXCHANGE RECEIPTS AND OUTGO

During the year 2006-07, the company spent Rs.40.60 Crores in foreign exchange. The company earned foreign exchange worth Rs.10.84 Crores during the year 2006-07.

6. ENERGY CONSERVATION

The company being an electronic industry, its operations are not energy intensive. However, the company frequently evaluates its processes and plant & machinery to economise on the energy consumption. It has done redistribution of the leads in Solar Photovoltaic plant so as to make optimum use of its captive DG sets.

More than 1,000 poplar plants have been planted. A nursery of poplar plants has been set up to provide saplings for further plantation next year. Thus the company is putting in efforts towards improvement of environment.

7. PARTICULARS OF EMPLOYEES

In accordance with the Companies (particulars of employees) Rules 1975 read with Sub-section 2-A of Section 217 of Companies Act 1956 as amended in 1988, none of the employees of the Company either employed throughout the year or for a part of the year under review was in receipt of remuneration more than minimum prescribed in the Rules.

8. IMPLEMENTATION OF HINDI, INDUSTRIAL RELATIONS & HUMAN RELATIONS

The company had very cordial industrial relations during the year. The management also initiated programmes for upgrading the skills of employees.

In order to ensure the use of Hindi, the employees continued to be trained in Praboth, Praveen, Pragya Hindi Courses, Hindi typewriting and use of Hindi Computers. Hindi fortnight was organized from 14.09.2006 to 28.09.2006. Various short time training programmes and workshops were conducted for workers and officers during the year.

Special workshops and various competitions in Hindi were organized and awards distributed to the winners.

9. WELFARE OF RESERVED CATEGORIES

All Government directives relating to the reserved categories such as Scheduled Castes, Scheduled Tribes, Physically Handicapped, Ex-servicesmen etc. continued to be implemented during the year. Total number of employees in these categories was 190, which represent about 28% of the total strength of the company as on 1st December, 2007.

PRESIDENT OF SUDAN, H.E. UMAR HASSAN AHMAD AL-BASHIR INAUGURATING THE PLANT AT KHARTOUM

H.E THE MINISTER MOHAMMED EHSAN ZIA INAUGURATING THE VILLAGE ELECTRIFICATION IN A VILLAGE OF PROVINCE KAPISA IN AFGHANISTAN

TECHNOLOGY TRANSFER TO SUDAN

OF SUDAN PRESIDENT LOOKING CLOSELY AT THE ASSEMBLY PROCESS

TECHNOLOGY TRANSFER TO SUDAN

TESTING & TABBING OF SOLAR CELLS

SOLAR HOME LIGHTNING SYSTEM INSTALLED IN VILLAGE QALA-E-LUQMAN IN AFGHANISTAN

NEW PRODUCTION FACILITY FOR SOLAR CELLS AT CEL

V. ADMINISTRATION & FINANCE

1. ADMINISTRATION

The Department of Scientific & Industrial Research was created in January 1985. The Administrative/Establishment Division of the Department looks after establishment matters related to creation of posts, promotion, implementation of the Flexible Complementary Scheme (FCS), a fast track promotion mechanism meant for the Scientists (Group'A'), deputations of officers abroad, vigilance, pension and other retirement benefits etc. It also looks after works related to General Administration such as office accommodation, provision of general services like medical reimbursement, CGHS facilities, staff welfare etc.

1.1 PROMOTION OF HINDI

- The official language Division of the Department, manned by an officer of the level of Asst. Director (OL), has made relentless efforts towards implementation of the instructions issued by the Department of Official Language for implementation of the official language policy in the Department and the autonomous and sub-ordinate offices under its administrative control. DSIR made the following efforts for use and promotion of Hindi in the official work and implementation of official language policy of the Government.
- Quarterly meetings are being held regularly under the chairmanship of Joint Secretary of the Department, who is the nodal officer for implementation of the official language policy in the Department.
- Quarterly progress reports, regarding use of Hindi in the Department are sent to the Department of Official Language regularly.
- The officers and the staff members requiring minimum knowledge of Hindi are nominated for different trainings under the Hindi Teaching Scheme.
- Hindi Week was observed from 14th to 21st September, 2007 by the Department in collaboration with the Department of Science and Technology. On the occasion, the message of Secretary, DSIR regarding progressive use of Hindi was conveyed. Hindi Week also witnessed widespread and closely contested competitions, at the level of both officers and staff, and in the areas of Poem recitation, Essay writing, Hindi typing and shorthand, noting and drafting competition, Translation competition, Quiz, lecture on scientific topics and Hindi dictation for class IV employees. A number of DSIR officers/staff members participated and won prizes.
- With a view to accelerate the use of Hindi in official work in the Department, a cash award scheme for noting & drafting in Hindi was introduced. Under the Scheme, three employees have been awarded cash prizes.
- A booklet containing a set of technical terms in Hindi useful to the Department and a set of standard drafts, dictionaries, scientific glossary and reference literature useful for official purposes have been distributed to officers/staff members.
- A two days Hindi workshop was organized during the year for scientists/officers/employees of the Department.

1.2 Staff Strength

The staff in position in different groups in the Department of Scientific & Industrial Research (other than CSIR/CDC and PSUs) as on 1st December, 2007 is given in table below:

	No. of Employees				
	Gen	SC	ST	OBC	Total
Group 'A'(Gazetted)	34	5	1	-	40
Group 'B' (Gazetted)	6	1	-	2	9
Group 'B' (Non-Gazetted)	13	4	-	1	18
Group 'C' (Non-Gazetted)	13	6	1	2	22
Group 'D' (Non-Gazetted)	5	6	-	-	11
Total					**100**

2. FINANCE

The financial summary giving the AE 2006-2007, BE 2007-2008 and RE 2007-2008 of Plan and Non-Plan schemes of DSIR is given in **Table I**.

3. CAG's REPORT

The extracts from CAG's report are given at **Annexure 11.**

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ANNUAL REPORT 2007-08

Department of Scientific and Industrial Research

Ministry of Science and Technology

www.dsir.gov.in

Table I: FINANCIAL SUMMARY

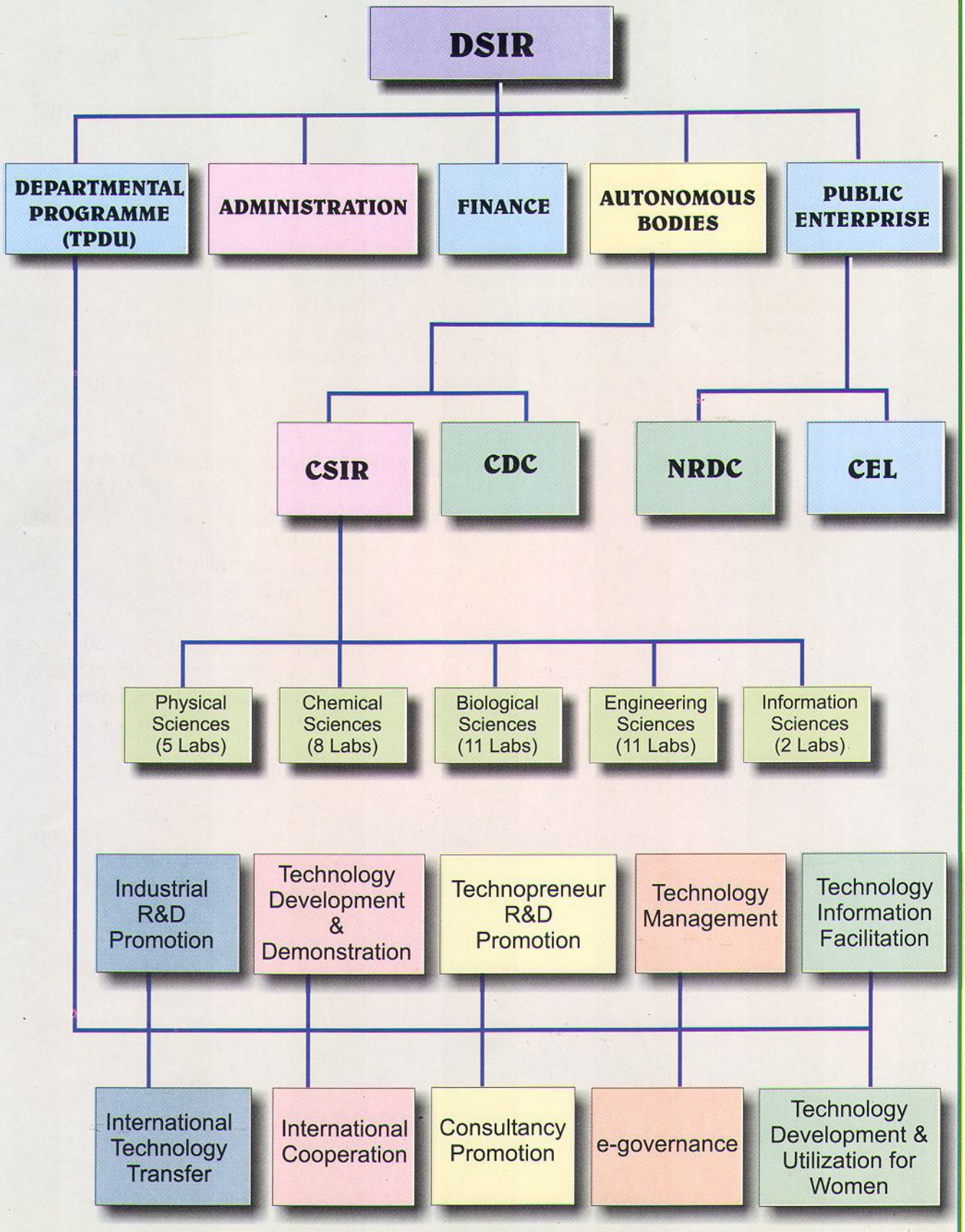
AE 2006-07, BE 2007-08, RE 2007-08 & BE 2008-09 of Various Plan and Non-Plan Schemes (Headwise/broad categorywise)

(Rs. in Cr)

	Actual Expenditure 2006-07			Budget Estimates 2007-08			Revised Estimates 2007-08			Budget Estimates 2008-09		
	Plan	**NP**	**Total**	**Plan**	**NP**	**Total**	**Plan**	**NP**	**Total**	**Plan**	**NP**	**Total**
Secretariat Economic Services - DSIR	**0.00**	**3.78**	**3.78**	**0.00**	**5.79**	**5.79**	**0.00**	**4.50**	**4.50**	**0.00**	**5.00**	**5.00**
Assistance to CSIR												
Administration	15.00	233.00	248	25.00	250.00	275.00	20.00	260.00	280.00	25.00	272.00	297.00
National Laboratories	669.44	324.41	993.85	864.00	445.81	1309.81	858.00	445.50	1303.50	960.00	471.00	1431.00
Scientists Pool	0.00	4.50	4.50	0.00	5.40	5.40	0.00	3.00	3.00	0.00	4.00	4.00
National S&T Human Resource Development	25.00	100.00	125.00	60.00	125.00	185.00	60.00	125.00	185.00	75.00	126.00	201.00
Intellectual Property and Tech. Management	30.50	0.00	30.50	30.00	0.00	30.00	36.20	0.00	36.20	34.00	0.00	34.00
New Millennium Indian Technology	33.61	0.00	33.61	55.00	0.00	55.00	55.00	0.00	55.00	60.00	0.00	60.00
Infrastructure Renovation and refurbishing	22.00	0.00	22.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Institute of Translational Research	0.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
A-Total Assistance to CSIR	**795.**55	**661.91**	**1457.46**	**1035.000**	**826.21**	**1861.21**	**1030.20**	**833.50**	**1863.70**	**1155.00**	**873.00**	**2028.00**
Assistance to CDC	**0.60**	**0.00**	**0.60**	**2.00**	**0.00**	**2.00**	**2.00**	**0.00**	**2.00**	**2.00**	**0.00**	**2.00**

(*Continued*)

	Actual Expenditure 2006-07			Budget Estimates 2007-08			Revised Estimates 2007-08			Budget Estimates 2008-09		
	Plan	**NP**	**Total**	**Plan**	**NP**	**Total**	**Plan**	**NP**	**Total**	**Plan**	**NP**	**Total**
Assistance to other scientific bodies												
Technology Promotion, Development & Utilization Programmes	14.14	0.00	14.14	21.30	0.00	21.30	16.10	0.00	16.10	25.00	0.00	25.00
Information Technology	0.28	0.00	0.28	0.60	0.00	0.60	0.40	0.00	0.40	0.40	0.00	0.40
APCTT Major works	0.00	0.00	0.00	0.10	0.00	0.10	0.30	0.00	0.30	0.60	0.00	0.60
DSIR building & infrastructure	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
Total TPDU	**14.42**	**0.00**	**14.42**	**22.00**	**0.00**	**22.00**	**16.80**	**0.00**	**16.80**	**28.00**	**0.00**	**28.00**
Support to R&D schemes to CEL	5.00	0.00	5.00	3.00	0.00	3.00	3.00	0.00	3.00	1.00	0.00	1.00
Investments in Public Enterprises - CEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
Loans & Advances - CEL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	2.00
Total CEL	**5.00**	**0.00**	**5.00**	**3.00**	**0.00**	**3.00**	**3.00**	**0.00**	**3.00**	**5.00**	**0.00**	**5.00**
Development and Promotion of Rural Technology, Export of Technology Informatics for Tech Transfer etc. NRDC	2.50	0.00	2.50	4.00	0.00	4.00	4.00	0.00	4.00	5.00	0.00	5.00
Invention Promotion Programme	2.50	0.00	2.50	4.00	0.00	4.00	4.00	0.00	4.00	5.00	0.00	5.00
Total NRDC	**5.00**	**0.00**	**5.00**	**8.00**	**0.00**	**8.00**	**8.00**	**0.00**	**8.00**	**10.00**	**0.00**	**10.00**
G Total	**820.57**	**665.69**	**1486.26**	**1070.00**	**832.00**	**1902.00**	**1060.00**	**838.00**	**1898.00**	**1200.00**	**878.00**	**2078.00**


DSIR
DEPARTMENTAL PROGRAMME (TPDU)
ADMINISTRATION
FINANCE
AUTONOMOUS BODIES
PUBLIC ENTERPRISE
CSIR
CDC
NRDC
CEL
Physical Sciences (5 Labs)
Chemical Sciences (8 Labs)
Biological Sciences (11 Labs)
Engineering Sciences (11 Labs)
Information Sciences (2 Labs)
Industrial R&D Promotion
Technology Development & Demonstration
Technopreneur R&D Promotion
Technology Management
Technology Information Facilitation
International Technology Transfer
International Cooperation
Consultancy Promotion
e-governance
Technology Development & Utilization for Women

I. AN OVERVIEW

1. INTRODUCTION

The Department of Scientific and Industrial Research (DSIR), one of the departments of the Ministry of Science and Technology was set up through a Presidential Notification, dated January 4, 1985 (74/2/1/8 Cab.). The mandate of DSIR includes promotion of industrial research for indigenous technology promotion, development, utilization and transfer. Shri Kapil Sibal is the Hon'ble Union Minister for Ministry of Science & Technology and Earth Sciences.

The Allocation of Business for the Department is as follows:

- All matters concerning the Council of Scientific & Industrial Research
- Registration & recognition of R&D units
- All matters relating to National Research Development Corporation (NRDC)
- All matters relating to Central Electronics Limited (CEL)
- Technical matters relating to UNCTAD & WIPO
- National Register for Foreign Collaborations
- Matters relating to creation of a pool for temporary placement of Indian scientists & technologists.

The primary endeavour of DSIR is to promote R&D by the industries, support small & medium industrial units to develop state-of-the art globally competitive technologies of high commercial potential, catalyze faster commercialization of lab-scale R&D, enhance the share of technology intensive exports in overall exports, strengthen industrial consultancy & technology management capabilities and establish user friendly information network to facilitate scientific and industrial research in the country. The DSIR has two public sector undertakings viz National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL) and two autonomous organization viz Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and specific assistance to "APCTT".

2. TECHNOLOGY PROMOTION, DEVELOPMENT & UTILIZATION PROGRAMME

The scheme "Technology Promotion, Development and Utilization (TPDU) Programme" is aimed at promoting technology development and industrial research in the country and encouraging its utilization by various section of economy, be it be industry, academic, scientific institution and the society at large. The specific components of the TPDU programme are:

- Industrial R&D Promotion Programme (RDI)
- Technology Development and Demonstration Programme (TDDP)
- Technopreneur Promotion Programme (TePP)
- Technology Management Programme (TMP)
- International Technology Transfer Programme (ITTP)
- Consultancy Promotion Programme (CPP)
- Technology Information Facilitation Programme (TIFP)

- Technology Development Utilization Programme for Women (TDUPW)
- Information Technology & e-Governance (IT&eG)

2.1 Major Achievements

Industrial R&D Promotion Programme

DSIR is the nodal Department for granting recognition to in-house Research and Development centres of industry. As on 31st December 2007, there were 1253 in-house R&D centres with DSIR recognition. Of these 147 in-house R&D centres incurred an annual expenditure of over Rs.5 crores each and 303 centres incurred an annual expenditure in the range of Rs.1 crore to Rs.5 crores.

During the year 2007, 92 in-house R&D centres were accorded fresh recognition and recognition of 420 in-house R&D units were renewed. As a part of the promotional efforts, the 21st National Conference on in-house R&D in industry was organised; and National Awards were presented to 9 industrial units. A publication on "Outstanding in-house R&D Achievements (2007)" and 3 issues of "In-house R&D in Industry Update" were brought out.

Scientific research foundations in the areas of medical, agriculture, natural & applied sciences and social sciences seek DSIR approval as Scientific and Industrial Research Organisations (SIROs) under the DSIR scheme of granting recognition to SIROs. The approved SIROs are eligible for availing customs duty exemption on imports and central excise duty exemption on indigenous purchase of essential scientific & technical instruments, apparatus, equipment (including computers), accessories, spare parts thereof and consumables, required for research and development activities. During the year 2007, 27 new SIROs have been accorded recognition.

The Department also issued 5 certificates for accelerated depreciation allowance on indigenous technology based plant & machinery involving an investment of Rs.67.98 crores.

DSIR is the nodal Department for registration of public funded research institutions, universities, IITs, IISc., RECs/NITs, for availing customs duty and central excise duty exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the year 2007, 28 such institutions were registered with DSIR; and 60 institutions were granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority for the approval of recognition of In-house R&D centres under section 35(2AB) of Income-tax Act, 1961. Fresh / renewal of approval were accorded to 82 companies by the prescribed authority after signing agreements of co-operation for research & development. R&D expenditures of the approved companies have also been examined by the DSIR and 61 reports have been forwarded to DGIT (E) in Form 3CL as required under the IT Act.

Technology Development and Innovation Programme

The programme has two sub-components:

(i) Technology Development and Demonstration Programme (TDDP) to support technology development efforts of industry R&D system and

(ii) Technopreneur Promotion Programme (TePP) to nurture the innovative spirit of individuals.

The component programme, Technology Development and Demonstration aims at catalyzing and supporting activities relating to

technology absorption, adaptation and demonstration including capital goods development, involving industry and R&D organizations. Under the programme, research, development, design & engineering projects for absorption and up-gradation of imported technology as well as development & demonstration of new and improved technologies are supported. While DSIR support is catalytic and partial, bulk of the financial contribution in any project is from the industry. TDDP has now been expanded by adding two more components, namely "TDDP Start Up" and "TDDP Small Business" under which support would be provided, as the name indicates, to Start Up companies to start their commercial operations and to small business to carry out both lab/pilot scale R&D as well as commercialization.

The Department, under this programme has so far supported about 193 R&D projects of industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving, industrial machinery and chemicals & explosives. So far 111 projects have been completed and over 35 technologies developed under the programme have been commercialized or under commercialization. During the year, 52 Technology Development Demonstration projects supported under the component scheme have been reviewed. There are 35 companies paying royalty/lump-sum as per the terms of agreement under the programme.

Technology Development projects have strengthened the linkages with more than 25 national research laboratories/ institutions such as NAL, Bangalore; RRL, Trivandrum; IICT, Hyderabad; CMRI, Dhanbad; IIP, Dehradun; C-DAC, Pune; Institute of Plasma Research, Ahmedabad; ER&DC, Trivandrum; Dalmia Centre for Biotechnology, Coimbatore; CMTI, Bangalore; which have been collaborating with industry in the specific research, design, development & engineering (RDDE) projects of high techno-socio-commercial impact. The Scheme has been found successful in synergizing the R&D efforts of industry and national research organizations.

The Technopreneur Promotion Programme (TePP) is a novel programme to extend financial support to individual innovators for converting their innovative ideas into working prototypes/models. Jointly operated by DSIR and Technology Information, Forecasting and Assessment Council (TIFAC) of the Department of Science and Technology (DST), TePP endeavours to tap the vast innovative potential of the citizens of India. So far, 209 projects of individual innovators were supported by DSIR (127) and TIFAC (82). Some of the successfully completed TePP projects during the year were Design of CPAP device for the treatment of sleep apnea, camera mouse for visually handicapped, tractor mounted pulveriser, periscope to reduce radiation effect from computers, instrument for spectral analysis of communication channels at high frequency, split type wood forming cutter, table top manual operated metal cutter/sheer machine, six-jaws universal wrench, water emulsification in fuel oil etc.

Technology Management Programme

The major objective of the Technology Management Programme is to provide technical inputs and support mechanisms for efficient transfer and management of technology. A number of technology and management related studies were taken up/carried out under the programme during the year. These include (i) Status of Technology and Scope of Technology

Improvement in Handloom, Powerloom and Readymade Garment Sector in West Bengal, (ii) Study on "Status & Prospects of Industries-Institute collaborations in emerging technologies"; (iii) Study on "Management of Automotive Sector"; (iv) Study on "Social Capital and Technology"; (v) Study on "An Empirical Analysis of the Status of Collaborative R&D in India"; (vi) Study on "Building Technological Capabilities through Strategic Development of Industrial Sector" and (vii) Study on "Competitiveness Evaluation for Emerging Technologies".

The case studies covering Technology Management aspects supported under the programme include Study on Industrial Clusters in the State of Uttar Pradesh covering Leather Processing Cluster of Kanpur, Silk Producing Cluster of Varanasi and Brass work cluster of Muradabad. DSIR under the programme has initiated the setting up of Centres for Technology and Innovation Management in PSG Institute of Management, Coimbatore, Madhya Pradesh Council of Science & Technology (MPCOST), Bhopal, IIT, Bombay, IHBT, Palampur and IED, Patna.

Newsletters are being brought out on specific technology management aspects in association with IIT Bombay, PSGIM Coimbatore, KCTU Bangalore and MPCOST Bhopal. Seminars/ workshops and training programmes on specific issues related to technology management are also organized. As an initiative under the programme towards curriculum development in technology management, four modules have been completed.

International Technology Transfer Programme

Under the International Technology Transfer Programme(ITTP), major activities completed or in progress during the year include: participation in India Fair, Melbourne; organisation of INDIATECH 2007 (11th Technology Trade Pavilion) at India International Trade Fair (IITF) 2007, Pragati Maidan, New Delhi; initiation of a project on Capability Building to Enhance Export Competitiveness & Facilitating Market Access for Indian Technologies and Technology Intensive Products; continuation of support to the Centre for International Trade in Technology at IIFT; completion of the project on Promoting high Technology Co-operation and Trade between India and CIS Countries in association with Department of Commerce; preparation of a comprehensive web enabled searchable database of 578 profiles of exportable technologies/projects from SMEs and its dissemination to embassies and missions; organization of fourth International Awareness – cum - training programme on packaging technologies and machinery including quality assessment systems for packaging materials and equipment (for food processing sector); and undertaking studies on trans-nationalization of SMEs in the pharmaceuticals sector, machine tool sector and auto-components sector. All these efforts have catalyzed the technology intensive and high value added exports. The percentage of such exports, in the overall exports, has steadily increased over the years. A large segment of exporting community has been trained and sensitized towards high value added exports.

International Cooperation

DSIR continues to play the role of being the focal point for the APCTT, an agency under UNESCAP facilitating the establishment of networks of technology transfer inter-mediaries in the region to promote cross-border business cooperation among SMEs.

During 2007, 463 technology offers and 944 technology requests were registered in the databank. About 492 technology queries were serviced and 73 technology match-making were facilitated among technology seekers and technology providers for technology transfer discussions. APCTT is presently implementing a twin portal to promote SMEs in the region – the www.technology4sme.net portal and www.business-asia.net portal.

DSIR has extended support to APCTT to implement the project, *Promotion of National Innovation Systems (NIS) in Countries of the Asia Pacific Region*. As part of the effort, the Centre has established an *NIS Online Resource Centre*. APCTT is also implementing the Grass Roots Innovations (GRI) Project, under which, two regional workshops in China and India and three national workshops in Indonesia, Philippines and Sri Lanka have been organized. Efforts were made to set up the Asia-Pacific Traditional Medicine Network (APTMNET) a viable and productive network linking the 14 member countries in the region. The 4th Meeting of APTMNET was hosted by the Ministry of Health, Malaysia in Kuala Lumpur during 23-24 July 2007.

Consultancy Promotion Programme

The programme relating to consultancy promotion, essentially, aims to strengthen our consultancy capabilities for domestic and export markets. During the period under report, IT Consultancy Clinic for SMEs in NOIDA, three Consultancy Clinics on Hosiery Industry at Kanpur, Jute & Jute Diversified Products at Kolkata and Design & Engineering centre for mould design used in Automotive & Durable Consumer Goods with high surface finish at Coimbatore were progressing satisfactorily. During the year the document on "Procedure for Selection of Consultants, Fee Structure for Consultancy Services and Standard Contract Agreement" has been finalized and submitted for Government approval for circulation to various government departments, PSU's and other organization as guidelines. The Consultancy Export potential studies in four African countries and four European countries were supported. In addition, eight projects of Consultancy Development Centre (CDC) under the grant allocated to CDC were supported. Also, technical inputs/supports were provided to Consultancy Engineers Association of India (CEAI) and other consultancy promotion organizations.

Technology Information Facilitation Programme

Technology Information and Facilitation Programme (TIFP) has the broader objectives of generating endogenous capacities for the development and utilization of digital information resources and facilitate accelerated S&T research. The strategy concentrates on facilitation of Indian content on S&T, avoid duplication of efforts, allow minimum overlap and maximum utilization of existing facilities. The specific achievements of the programme during the period of report include:

(i) Promotion of content development – such as database on Pest Management Technologies for major Oilseeds and Pulse Crops of Central India, Database on wild ornamental plants of Himalayas (Solan), Digital database of Bishnupur terracotta art and sculpture and traditional design of Potchitra, Baluchori and Madhubani, Database on Metallopharmaceuticals, Floral potential of J&K State, Indian Wood Insect Database, and Design and development of online database on Mycorrhiza, Decision support software system for Cereals, Millets, Pulses and Tuber crops and establishment of an Agricultural digital information centre;

(ii) Development of national websites / portals such as Science & Technology, Coastal Hazards Portal, Indigenously developed Textile Technology Research, Industrial R&D in India, Indian Academic & Research Establishments, Energy Information Support Services for the Indian Industry, Integrated Management Systems;

(iii) Documentation of community knowledge, traditional knowledge and oral traditions in various districts of the states of Maharashtra, Karnataka, Tamil Nadu, Kerala, Rajasthan and West Bengal;

(iv) Establishment of a Virtual Information Centre (VIC) http://www.vic-ikp.info at the ICICI Knowledge Park (ICICIKP), Hyderabad and

(v) Support to three Surveys and R&D studies viz., Feasibility Study on the Self-Sustainability of Information Support Facilities in and around Industrial Clusters of SMEs, Impact of Technology on Quality of Service Deliveries in Technical and Management Libraries in Karnataka, Manipal and GIS based Digital Atlas of the Sacred Groves of the North East India.

The programme also supported several education and training programmes on digital content development. Six sensitization-cum awareness programmes have been organized in different part of the country to create awareness and solicit good project proposals.

Information Technology & e-Governance

Information Technology for e-Governance has been initiated in the Department during the middle of the Tenth Plan by allocating a fixed percentage of the plan funds of the TPDU Scheme to create an IT environment in the Department in conformity with the National e-Governance Action Plan. While various client server applications like INTRADSIR, EXTRADSIR, DMIS, CINFOSYS, CPGRAMS, PIMS, FCAIMS were kept operational during the year, some additional facilities were also created during 2007. These include a modernized pay bill processing system and an instant messaging and pop up facility. Secured on-line sharing of information between DSIR and its autonomous bodies and public enterprises has been made possible through EXTRADSIR. Further NET security has been strengthened by introducing a three level security system.

Technology Development and Utilization Programme for Women

In pursuance of the recommendations of the Inter-Departmental Committee set up to consider issues regarding Gender Budgeting, the Department established a "Gender Budgeting Cell", initiated steps to enhance the share of women in respect of beneficiary oriented schemes, and designed a scheme namely, Technology Development and Utilization Programme for Women (TDUPW) in 2005-06. The programme is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. Department has supported about 20 projects so far and seven projects have been completed.

During the year 2007-08, Department adopted a pro-active approach by giving wide publicity to the programme and encouraging institutions and voluntary organizations working in the field of empowerment of women to take up more projects of significant nature and beneficial to women. In this regard, five sensitization-cum-awareness programmes in various parts of the country were organized.

3. AUTONOMOUS INSTITUTIONS

3.1 Council of Scientific & Industrial Research (CSIR)

The Council, the largest publically funded industrial R&D organization of the world, ever since its establishment in the year 1942

has contributed immensely not only in terms of many new products and facile technological processes but has also contributed significantly towards deeper scientific understanding by way of basic research. The range of its S&T contributions is unique, wide and significant.

As multi-disciplinary, multi-locational network of 38 national laboratories and 39 outreach centers, CSIR over the years, has matured into a performance driven and knowledge centric organization. Its laboratories are rich in talent, technology, and infrastructure which are the basic building blocks for creating and nurturing scientific & technological innovations, both incremental and breakthroughs. Predominantly, it strives to achieve excellence in science; global competitiveness in technology based on high science; and innovation in various key areas of S&T. It has been a proactive generator of technologies for industrial growth, S&T anchor for strategic sector, technology hub for societal welfare and science base for progression of knowledge capital. Its achievements subsume a wide science continuum from aerospace to biology to energy to materials & minerals.

The Report covers S&T contributions of CSIR in creating Societal, Strategic, Private and Public goods and services. Most of CSIR institutions have worked or provided services in one or more of these sectors and the outputs had direct socio-economic and in many cases techno-commercial relevance.

Recognizing that S&T inputs could significantly contribute to improve the quality of life and public services, institutions have provided S&T based solutions to mitigate the vulnerability and improve the quality of life especially for rural society. Sustainable development of rural areas needs to be linked to the development of people. It can be achieved by significant technological interventions in many areas including drinking water, shelter, energy, environment, health, food, farm and non-farm sectors. The institutions having a direct bearing in the sector of **societal goods and services** reported several achievements namely: development of a novel hybrid Reverse Osmosis unit for desalination of highly saline seawater; a solar power operated community reverse osmosis desalination unit, is of much benefit to those areas where electricity is not reliable and stable, an easy to assemble, light weight instant house for disaster victims; a new cultivar of haldi – himhaldi - as a substitute of turmeric for bruises, corns and sprains; bio-village approach for widespread cultivation of aromatic and herbal plants; and new variety of coffee species having low caffeine. Yet another contribution is development of a simple and cost effective raft cultivation system for the sea weed *gracilaria edulis* from which agar is extracted, which is used as the chewing agent in food, confectionary, softdrinks etc.

Strategic sector has always been of importance for a few of the CSIR institutions wherein the output reported has been of technological importance, such as: development and fabrication of MEMS Acoustic sensors used in satellite launch vehicles; Vacuum Enhanced Resin Infusion Technology for weight and cost reduction of the aircraft parts, especially of wings; development of Drishti - a transmission meter for runway visibility indication; development of a production standard Aircraft SARAS. Strategic presence also extends to the domain of materials, minerals and energy as well wherein optical fibre based temperature sensors having applications in power transmission and a novel process for making low cost, non toxic, highly effective shielding

material for attenuating x-ray and gamma radiations utilizing industrial waste of red mud and fly ash for the first time in the world, have been reported.

Ever since its establishment, CSIR has been catalyzing the growth of many of the industries, i.e. creation of **public and private goods and services**. This covers the distinct, yet cognate, areas of biology and biotechnology, chemicals and drugs and pharmaceuticals sectors all of which fuel industrial growth, CSIR has a traditional strength. Some of the new drugs and pharma related developments include processes for high level production of clot specific streptokinase and recombinant staphylokinase-two potent thromobolytics. The technologies have since been licensed. Another achievement in this area relates to development of herbal formulation from *Murraya Koengii* and *tribulus terrestris* useful for the treatment of prostate cancer. Yet another development is an all purpose skincare cream formulation with *aloe vera* as base and useful in wound healing and as antifungal formulation. In this sector some other notable achievements have been the development of a high yielding variety of *foeniculum vulgare,* whose essential oil is much coveted in culinary articles, cordials and toilet articles. Likewise, a process for extraction of virgin coconut oil which is colourless, having an intense coconut aroma, has been much appreciated as a functional food and which also acts as antibacterial, antiviral and antifungal. In the area of environment, a three step tanning methodology which is a near zero waste water discharge leather processing technology has been well appreciated by industrial stake-holders. Another environment friendly technology is a process for heptafluoropropane which is a substitute for halon, a chemical used in fire fighting. Based on yet another CSIR technology, a plant using a catalytic process for the manufacture of epichlorohydrin from allyl chloride has been commissioned in Thailand, which is a first plant of its kind.

CSIR's contributions to the growth of core knowledge has also been stupendous. Development of hardware and software for monsoon forecasting, in-silico drug target identification, predicting the crystal structure of *lysine epsilon-aminotransferase,* which is a target for latent TB; creation of Indian genome variation consortium database having immense implication in predictive and preventive medicine, are a few of such achievements. Besides, CSIR's basic research contributions have maintained a rising trend by publishing 3488 research papers in SCI journals of national and international repute during the year. The Average Impact Factor per paper stands at 1.983. Many research papers were published in topmost journals, viz. 'Science', 'Cell', 'Nature' in Biological Sciences; 'Chemical Review', 'Angew Chemicals International' in Chemical Sciences; and 'Physics Review Letters', 'Journal of Applied Crystallography', 'Applied Physics Letters' in Physical Sciences. Upholding its commitment to the challenges of IP related matters, CSIR filed 655 patents abroad and 169 patents in India whereas it has been granted 316 patents abroad and 262 in India. It has secured 21 copyrights as well.

3.2 Consultancy Development Centre

The Consultancy Development Centre (CDC) came into being as a registered society in January 1986. The CDC was approved as an autonomous institution of DSIR in December 2004. The Centre is managed and guided by a Governing Council headed by Secretary, DSIR. The Governing Council consists of representatives of consultancy organisations,

R&D institutions, Government Departments, academic institutions, public sector units, etc. CDC has membership representing various types of consultancy organisations and individual experts associated with consultancy. The activities of CDC pertain to educational programmes in consultancy management, competency enhancement through training and skill building programmes, development of young professionals and women to opt for consulting as a career option and studies/projects relating to development of the consultancy profession.

During the year 2007-08, CDC has developed linkages with the Indira Gandhi National Open University for development of collaborative educational programmes comprising Certificate, Advanced Diploma and Degree Programmes in consultancy Management. Modalities are being finalised to commence these programmes from the year 2008-09. Modalities for extending the collaborative MS degree Programme in consultancy management with BITS Pilani to Chennai, Hyderabad and Bangalore have been finalised. CDC has also initiated efforts towards development of course material for these two programmes. Facilitation in selection of consultants is a new initiative taken by the Centre during the year. Training and Skill building programmes on consulting were carried out. Three interactive seminars on development of women consultants were conducted. Tenth Consultancy Congress on Outsourcing: Role of Consultants was held from 15-16 January 2008. Studies on Consultancy capabilities and Opportunities in India, Benchmarking best consulting practice and status of women consultants in India have been initiated. In addition, sectoral state-of-the-art reports in transportation sector, services sector and agro and food processing sectors have been initiated.

4. PUBLIC SECTOR ENTERPRISES

4.1 National Research Development Corporation (NRDC)

The Corporation provides comprehensive technology transfer services and acts as a catalyst for transforming innovative research into marketable industrial products. During the year, the Corporation's income from its principal source of revenue i.e. Lumpsum Premia and Royalty on the licensing of technologies to industry was Rs. 412.37 lakhs, as compared to 380.40 lakhs in the previous year. During the year 2006-07, the Corporation entered into Memorandum of Understanding/Agreement with the organisations like Indian Association for Cultivation of Sciences, Kolkata; Vasant Dada Sugar Institute, Pune; Synthetic Silica Products, Kanpur; G.B. Pant University, Pantnagar; RRL, Thiruvananthapuram; Raman Centre for Applied and Interdisciplinary Sciences, Kolkata. As a result, 39 new processes were assigned to the Corporation for commercialization as compared to 30 processes during the previous year. The Corporation signed 44 licence agreements during the year. Some of the major technologies licensed by the Corporation during the year: Seri Gold- A Powerful General Disinfectant for Sericulture used for the Disinfection of Rearing Houses and Rearing Equipments, Mulberry Leaf Health Drink, Pithplus Magnesium Silver Chloride Seawater Activated Battery, Bio-Larvicide, Porus Conducting Carbon Paper, Night Time Highway Systems for Automobiles (Auto Dipper). During the year, the corporation has collaborated with various Patent Offices in the country and organized 23 seminars and awareness programs on "Patenting in Biotechnology", "Emerging

Scenario of Intellectual Rights Protection", Intellectual Property & Innovation Management in Knowledge Era", "European Patent Laws and Exploitation Strategies".

The Corporation has awarded various innovations in the key areas in the field of Agriculture, Biotechnology, Chemical and Allied, Electrical, Electronics, Mechanical etc. It also announced cash awards amounting to Rs.5.00 Lakhs for the new inventions on 2006. The Corporation also announced one WIPO Gold Medal for the best invention "Development & Commercialization of Novel Process Technology for Removal of H2S and Mercaptans from LPG through Continuous Film Contractor (CFC)" to Dr. R.P. Verma and Associates.

4.2 Central Electronics Limited (CEL)

Central Electronics Limited (CEL) has been pioneer in India in Solar Photovoltaics, Railway Signaling & Safety Equipment, Strategic Electronics (PCM and Piezo ceramics). CEL has up-graded and up-scaled its Solar Photovoltaic (SPV) operations from 2 MW to 10 MW during 2006-07 and has got most modern state-of-the-art solar cell process technology to meet domestic and international competition. CEL has successfully developed Digital Axle Counters & 40 Detection Points Multisection Digital Axle Counters conforming to European Standard CENELEC SIL-4 for Indian Railways.

CEL achieved the ever highest production turnover of Rs.139.26 crores in 2006-07 with an operating profit of Rs.11.24 crores against Rs.102.74 crores in 2005-06 with operating profit of Rs.5.90 crores.

CEL is diversifying in other areas to achieve a projected turnover of Rs.250 crores by year 2011-12.