WORLD METEOROLOGICAL ORGANIZATION

PROGRAMME ON PHYSICS AND CHEMISTRY OF CLOUDS AND WEATHER MODIFICATION RESEARCH

WMP

REPORT SERIES

No. 40

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

2001-2002

WORLD METEOROLOGICAL ORGANIZATION

PROGRAMME ON PHYSICS AND CHEMISTRY OF CLOUDS AND WEATHER MODIFICATION RESEARCH

REGISTER OF NATIONAL WEATHER MODIFICATION PROJECTS

2001-2002

WMO-TD No 1191

TABLE OF CONTENTS

I. INTRODUCTION

As part of the activities which WMO carries out in its Programme on the Physics and Chemistry of Clouds and Weather Modification Research, a Register of National Weather Modification Projects is kept. The Register has existed since 1975 when the Seventh World Meteorological Congress agreed that an inventory of activities within Member countries related to weather modification should be initiated and maintained. Periodic reviews have all recommended that the Register be continued. The Register is providing information also of interest to number of UN programmes outside WMO.

This present Register is based on information obtained from Member countries on experiments and operations sponsored by government agencies or private concerns that took place during 2001 and 2002.

To assist the reader in understanding the content of each of the 12 columns used in the tabular presentation found within, detailed explanations are provided in Section II. These columns contain information that was obtained from WMO Member countries in response to questionnaires sent to them in February 2002 and March 2003.

The names of Member countries who provided the information reported in this Register are listed in Sections III. Section VII provides summaries of completed projects and Section VIII indicates which countries reported that no weather modification activities had taken place in 2001 and 2002.

It should be nearly 70 Member countries which have responded that they do have interest in weather modification although not all of them have carried an operational or research oriented weather modification activity.

Requests for further information concerning the projects reported may be addressed to the reporting agency for each country which is indicated in Section V. The WMO Secretariat would be pleased to assist if requested.

Agr.	=	Agricultural	Muni.	=	Municipal
Def.	=	Defense	(P)	=	Private
Enr.	=	Energy	Rec.	=	Recreation
For.	=	Forestry	Res.	=	Research
(G)	=	Government	Trans.	=	Transportation
Hyd.	=	Hydrological	Wea. Serv.	=	Meteorological

Column 8: Apparatus, seeding location

Abbreviations are as follows:

Air	=	Airborne	G/B	=	Ground-Based
A/C	=	Aircraft	Temp.	=	Temperature

Column 9: Agents, dispersal rates

Self-explanatory.

Column 10: Characteristics of clouds treated, seeding criteria

LWC	=	Liquid Water content	Temp.	=	Temperature
Obs.	=	Observations			

Column 11: Active period during reporting year

Months of activity are inclusive.

Jan	=	January	July	=	July
Feb	=	February	Aug	=	August
Mar	=	March	Sept	=	September
Apr	=	April	Oct	=	October
May	=	May	Nov	=	November
June	=	June	Dec	=	December

Column 12: Documentation

"EIS" indicates that an environmental impact study has been made; "C/B" indicates that a costs and benefits analysis has been made.

III. MEMBER COUNTRIES REPORTING 2001 PROJECTS

Page

IV. REGISTER OF 2001 REPORTED PROJECTS

ARGENTINA											
AR-1	Hail suppr Res. Op.	Target area 3200 km^2 Control area 4500 km^2	Mendoza hail suppression programme	Mendoza	1999 6 months by year (Oct-March) Yes	Agr (G) Res. Found. (G) Univ.	4 aircrafts pyrotechnic flares cloud bases, cloud top in cloud between –5°C, -10°C	AgI 40,000 flares x20g and 2000 bips by year (mean of 4 year) 1200 kg each year (means between 1999-2003)	Convective clouds warmer than +10°C. Cloud top colder than –20°C. Microstructure unseeded cloud measured. All clouds are seeding.	Since October until March between 1999-2003 60 by year	Comp Hist. Records Crop damage. Doc planned and available EIS-YES C/B-YES
AUSTRALIA											
AU-1	Op. PE Inc. Precipi tation	Target area 6000 km^2	Tasmanian Area Cloud Seeding Operation 2002 (TASCO 2002)	Central plateau Tasmania 41°30'S – 43°00'S 145°30' – 146°30' E	1998 Every year Yes	Energy (G)	1A/C with acetone burner seeding in-cloud at –10°C level and cloud LWC> 0.1 gm^{-3}	AgI at 250 g/hr 20 kg for the year	Orographic and layer clouds with bases colder than 10°C and tops colder than 0°C but warmer than -20°C. Seeding criteria: cloud top temp. LWC, depth of cloud, cloud cover	April – Nov 244 days	Evaluation based on historical records Report available EIS-YES C/B-YES
AUSTRIA											
AUS-1	Op. Hail	1,800 km^2 No control area	Hail test project STYRIA	46°30'N – 47°15'N 15°30'E – 16°00'E	1985 Every year Yes	Agr (P)	3 A/C with acetone burners and pyrotechnic flares for seeding cloud bases	AgI 11l/hour annual consumption 750l, 49 kg	Convective clouds, bases colder than 10°C and tops colder than –20°C. Seeding criteria: subjective decision based on regional weather forecasts and C-band radar data	May – August 16 days	Evaluation based on historical records, crop damage and hail pad data. Report available EIS-No C/B-No
AUS-2	Op. Hail	500 km^2 No control area	Hail test project Lower Austria	48°15'N 48°30'E 15°20' – 15°50'E Lower Austria	1981 Every year Yes	Agr. (P)	3 A/C with acetone burners and pyrotechnic flares for seeding cloud bases	AgI, 11l/hour annual consumption 617l, 40kg	Convective clouds with bases colder than 10°C and tops colder than –20°C. Seeding criteria: subjective decision based on regional weather forecasts and C-band radar data	May-August 11 days	Evaluation based on historical records, crop damage and hail pad data, report available EIS-No C/B No

BULGARIA											
BG-1	Op. Res. Hail	15,670 km^2	Bulgarian Hail Suppression Project	NW Bulgaria 43^{0}20' –44^0 0'N 22^{0}30'–24^{0}40' E South Bulgaria 42^0 0'–42^{0}35'N 24^{0}00' –26^{0}30'E	1969 Interrupted Yes	Agr. (G)	Rocket-based pyrotechnic flares for in-cloud seeding at temperatures -5 to –12^0 C	AgI, 43g/rocket Annual consumption 157.5 kg	Convective clouds, bases warmer than 10^{0}C, tops colder than -20^0. Seeding criteria based on radar echo, cloud heights or cloud top temperature and reflectivity	May - Sept. 48 days	Evaluation based on comparison with historical records, crop damage. Evaluation document done but not available to WMO EIS – No. C/B –Yes.
CANADA											
CAN-1	Op. Hail	26,000 km^2	Alberta Hail Suppression Project	Province of Alberta (Lacombe to High River). Priority given to cities of Calgary and Red Deer	1996 Every Year Yes	Ins. (P)	Seeding cloud-base and cloud-top at temp. –8 to –15^0 C with acetone burners and pyrotechnic flares from 3 A/C	AgI, Flares: one 20g flare every 5 sec. In cloud top and 150g flare / run at cloud base. Annual consumption 195.0 kg	Convective clouds bases colder than 10^{0}C, tops colder than 0^{0}C but warmer than –20^{0}C. Seeding criteria : radar-defined cells with max. reflectivity, 40 dBz, extending above 3kms and >10km^3	1 June-15 Sept, 43 days	Evaluation based on comparison with historical records. Document available EIS-No C/B - Yes

IV. REGISTER OF 2001 REPORTED PROJECTS

CHILE											
CHI-1	PE Op (R)	Target area 1000 km^2 control area 160 km^2	Precipitation Enhancement Programme Cachapoal River basin	Cachapoal River Basin 34°00S, 34°20'S 70°20'W-70°45'W	2000 Every year Yes	Agr (G)	Ground based seeding from 8 acetone burners	Agl. Total consumption 9.81 kg	All cloud types with bases colder than 10°C and tops colder than –20°C . Seeding criteria based on synoptic systems (e.g. cold fronts in area) and precipitation observed in Basin	Apr-Sept. 16 days	Evaluation based on historical precipitation behaviour inside and beyond the Basin and the 2000 precipitation amounts. Report available
CHINA											
CN-1	Op. PE (E) (R) Hail Decrea s Ppcn			Henan Province	1988 Every year Yes	Wea. Ser. (G)	In-cloud and cloud top seeding using artillery shells pyrotechnic flares, rockets artillery shells, explosives and 1 A/C	Agl,. 300 g/hr. Total consumption 20 kg	Convective and layer clouds with bases both warmer and colder than 10°C and tops warmer and colder than –20°C.	March – October 150 days	Evaluation based on comparison with historical records, crop damage and hail pads. Document available. EIS-No C/B-Yes
CN-2	Op. Res PE (E) (R) Inc. PR Hail	Target: 6,800 km^2 Control: 2,000 km^2	Precipitation Enhancement Hail suppression	Catchments of two reservoirs in Beijing province 3 counties in Beijing	1990 Every year Yes	Agr. (G)	In-cloud seeding with one A/C using liquid nitrogen generators. Rockets and artillery shells used for hail suppression.	Liquid nitrogen, 80 kg/hour Total consumption 1120 kg	Stratiform clouds with bases colder than 10°C, top temperature being between 0^0 and – 20°C. Seeding criteria presence of stratiform clouds.	January – December for precipitation enhancement May – October for hail suppression 50 days	Evaluation based on randomization and crop damage No document planned. EIS - Yes C/B – Yes

IV. REGISTER OF 2001 REPORTED PROJECTS

CN-3	Op. PE (E) (R) Hail	All regions of shandon g province	Project of Precipitation Enhancement and Hail Suppression of Shandong Province	Shandong Province	1988 Every year Yes	Wea. Ser. (G)	In-cloud seeding at -5^0 to -10^0 C with 2^0 A/C using acetone burners. Rockets and artillery shells used for hail suppression.	AgI, 320 g/hr Total consumption 14.4 kg	Stratiform and convective clouds with bases colder than 10°C, top temp. being between 0^0 and –20°C. Seeding criteria : cloud depth in excess of 2 km. with abundant supercooled water. Radar echo>30dbz for hail suppression. For PE, 24 hr rainfall is more than 5 mn.	March – October 52 days	Evaluation based on crop damage and comparison with floated control area. No document planned EIS - No C/B – Yes
CN-4	Op. Dev. PE (R) Inc.	Target: 12000 km^2	Weather modification Operation	West of Jilin Province	1958 Every year Yes	Agr. (G) Other (G)	In-cloud seeding with one A/C, and all types of generators.	AgI, at 0.5 kg per operation dry ice at 50kg per operation. Total consumption 20kg (AgI), 2000 kg (dry ice)	Orographic clouds with bases warmer than 10°C and top temp. colder than –20°C.	April-September 150 days	Evaluation based on comparison with historical records and randomization. Document available. EIS – Yes C/B – Yes
CN-5	Op. Res Dev. (E) (R) Ext. Inc. Hail	Target: 75,000 km^2 Control 50,000 km^2	Precipitation Enhancement over the upper yellow river and E. Qinghai. Hail suppression in N and E. Qinghai	Qinghai Province	? Every year Yes	Agr. (G) Enr (G) For (G) Hyd. (G) Res. Found (G)	In-cloud and cloud top seeding from 1 A/C, rockets and artillery shells with acetone burners, liquid spray and explosives.	AgI, Total annual consumption 21.6 kg at 1kg/hr	All types of clouds with bases colder than 10°C and top temp colder than 0°C but warmer than 20°C.	March – Nov for PE. Hail during June-Sept. Total 217 days	Evaluation based on crop damage. Hail pads and historical comparisons. Report planned. EIS- No C/B- Yes

IV. REGISTER OF 2001 REPORTED PROJECTS

CN-6	Op. Res Dev PE Hail (E) (R) Inc.	Target: 3,500 km^2 Control 3,200 km^2	Technical research in PE in Tian Shan Mountain area	Xinjiang Province North Mountain Area of Urungi	2001 Every year Yes	Agr. (G) (P)	In-cloud seeding with one A/C, rockets and artillery shells at temp.between –6 to –15°C.	Agl, 100 g/10min. Total annual consumption 200 kg	All types of clouds with bases colder than 10°C and top temp colder than -20°C. Seeding criteria cloud top height 4-7 kms . Radar reflectivity in excess of 40 dbz for hail and 25 dbz for PE.	May-Sept but some areas all year around. 240 days.	Evaluation based on crop damage and historical comparisons. Document EIS-No C/B-No
CN-7	Op. Dev PE (E) Hail	Target: 125,000 km^2	Project of Precipitation Enhancement and Hail Suppression	Anhui Province	1958 Interrupted Yes	Wea. Serv. (G)	In-cloud and cloud top seeding with 11 A/C, rockets and artillery shells using acetone burners. In cloud temperatures –<4°C.	Agl. 320g/hour. Total annual consumption 46kg.	Convective clouds with tops colder than -20° C. Seeding criteria: Radar reflectivity between 10dbz and 15 dBz. Cloud contains supercooled water and is judged deep.	150 days.	Evaluation based on crop damage and historical comparisons. Document available EIS-No C/B-No
CN-8	Op. Res PE (E) (R) Hail	Target: 100,000 km^2	Precipitation Enhancement and Research aspect of hail suppression	Hebei Province	1990 (PE) 1996 (Hail) Every year Yes	Weather Service (G) Agr (G) Hyd. (G) Res. Found (G)	In-cloud seeding with rockets artillery shells and 1 A/C with acetone burners.	Agl, 4.2g/min. Total annual consumption 25 kg	Orographic and stratiform clouds with bases colder than 10°C and top temp. between 0 and – 20° C. Seeding criteria: cloud base and cloud top temperature LWC of cloud.	March-Oct 180 days	Evaluation based on comparison with historical records., crop damage and hail pads. Document available EIS-No C/B-Yes
CROATIA											
CR-1	Op. Hail	Target 24,000 km^2	Hail Suppression	North Croatia, between Sava and Drava Rivers	1976 Every year Yes	Agr. (G) Wea. Ser. (G) Ins. (P)	Ground- based seeding with 487 acetone burners and in-cloud seeding with rockets.	Agl, 10 kg per seeding day. Total consumption 452 kg	Convective clouds with bases colder than 10°C and tops colder than –20°C. Seeding criteria: cloud tops above – 28° C level and height of 45 dBz echo in excess of 1.4 km above 0°C level.	May – Sept. 44 days with seeding	Document on evaluation planned and will be available internationally when finished. EIS-No C/B -No

IV. REGISTER OF 2001 REPORTED PROJECTS

FRANCE											
FR-1	Hail Supp Res. Op.	Target area 60000km^2 Control area 420000 km^2	Association nationale d'étude et de lutte contre les fléaux atmosphé riques	Bassin Rhodanien et vallée de la Loire	1952 Every year Yes	Agr. Asso. Inter départe mentale	657 ground generators Acetone burner. Ground seeding material	8g/hour/ generator 509 kg per year	Convective clouds warmer than +10°C and cloud top temp colder than –20°C. Microstructure unseeded cloud not measured. Hailstones forecasting causing damage to crops.	15 avril – 15 october 49 days	Grélimètres. Report planned available. EIS-Yes C/B-Yes
FR-2	Op. Res. Hail Supp Frost	Target area 80x40 km^2 Control area 100x60 km^2	Test de lutte antigrêle utilisant sels hygros copiques	Department Tarn et Garonne. Montauban	1995 Every year Yes	Agr (P) AEAG	1 aircraft cloud base and pyrotechnic flare generator.	NaCl – 2 flares of 1 kg every mn 160 kg	Convective clouds. Cumulo congestus and cumulonimbus colder than +10°C tops colder than – 20°C.	20th April – 30th September 2002. Averages 15 days	Hail pads. Comparison to non seeded cells with TITAN. Doc available in WMO EIS-Yes C/B-Yes
GERMANY											
GE-1	Res. Op. Hail	Target: 4,400 km2	Hagelabwehr/ Hagelforschu ngsverein Rosenheim	Northern side of the Alps, hilly terrain between 500-1900 m	1975 Every year Yes	Municipal	Cloud base seeding with acetone burners from 2 A/C	Agi, 0.5 kg/hour total annual consumption 37 kg	Convective clouds with bases warmer than 10oC and tops colder than 0oC but warmer than –200C. Seeding criteria based on temperature type of advection vertical windspeed, humidity, fronts, troposphere height ,radar echoes, infrared satellite photos and sferics.	May Sept. 19 days	Evaluation based on documented hailfall. Evaluation document available. EIS-No C/B-No
GREECE											
GR-1	Res. Op. Hail	2,350 km^2 Target area	Hellenic National Hail Suppression Project	NW Greece	1984 Interrupted Yes	Agr. (G)	Cloud base and cloud top seeding with pyrotechnic flares from 2A/C.	AgI 240 g/min 58.1 kg	Convective and orographic clouds with bases colder than 10°C and tops colder than -20°C. Seeding criteria: cloud tops at least 5 km and radar reflectivity at least 35 dBz.	May - Sept. 24 days	Evaluation based on comparison with historical records., crop damage and hail pads. Evaluation available EIS-Yes C/B-Yes

IV. REGISTER OF 2001 REPORTED PROJECTS

GR-2	Op. Hail	56 km^2 Target area		5 different Greek provinces	1982 Every year Yes	Agr (G)	G/B Hail canons and sound shock waver		Convective clouds	April to October about 25 days each year	Evaluation based on comparison with historical records and crop damage. No evaluation report EIS-No C/B-No
HUNGARY											
Hu-1	Op. Hail	Target 8,500 km^2	NEFELA	Baranya, Somogy Tolna counties	1991 Every year Yes	Agr (G) (P)	Gound based seeding using 104 acetone burners	Agl . Total consumption 150 kg	Convective clouds with bases colder than 10°C, tops both warmer and colder than –20°C. Seeding criteria : forecast of thunderstorms.	May-Sept. 39 days	No Evaluation provision EIS – No C/B - No
IRAN, ISLAMIC REPUBLIC OF											
IR-1	Pre Enh Water Suply Aug Op	Target and control area 300 km radius	Yazd 2001	Central Iran Yazd Kerman Esfahan Chaharmahal	1999 Yes	Energy	1 aircraft explosive cloud top and in cloud seeding	Agl 5.4 kg/year	Convecitve orographic layer clouds colder than +10°C top temp colder than 0°C but warmer than –20°C suitable cloud coverage	Jan-Feb-March 90 days	Comparison historical records document planned EIS-No C/B-No

IV. REGISTER OF 2001 REPORTED PROJECTS

ISRAEL											
IS-1	Op. PE (R)	Target 5,000 km^2 Control 1,500 km^2	Israel Rain Enhancement Project	Northern Israel	1960-1975 Experimental. Since 1975- operational Every year Yes	Agr (G) Hyd (G)	40 G/B acetone burners and 3 A/C with acetone burners seeding at cloud base	AgI G/B at 12 g/hour each. A/C at 500 g/hour each. Total consumption 200 kg	Convective clouds with bases colder than 10°C, tops both warmer and colder than –20°C. Microstructure of unseeded clouds measured. Seeding criteria cloud tops below –8°C and wind direction.	Nov - April	Evaluation based on historical records. Document available EIS-No C/B-Yes
JAPAN											
JP-1	Rs PE PR Inc. R	Target area 500 km^2	Study on feasibility of orographic snow cloud modification by seeding	Niigata and Gunna Prefectures	1994 Every year Yes	Wea. Ser. (G) Hyd. (G)	Cloud top seeding with dry ice from 2 A/C	Dry ice. 10-30 g/sec Total consumption: 1500 kg	Orographic clouds with bases colder than 10°C and top temp between 0°C and –20°C. Seeding criteria: cloud top temp > –20°C, horizontal uniformity of clouds and liquid water path > 0.2 mm	Feb - March Dec.	Evaluation based on in-situ microphysical data, radar reflectivity and numerical simulations. Report available in Japanese. EIS – No C/B - Yes
KOREA, REPUBLIC OF											
KO	Prec Enh Supp Aug Dev	Target area 400 km^2	Development of Weather Modification Techniques in Korea	Kyungnam Province	June 2000 Every year Yes	Wea Ser (G)	2 aircraft generator with pyrotechnic flare and solid dispersal. Seeding in cloud temp – 4°C	AgI 4g/min. 0.6 kg peryear Dry ice 12g/sec 80 kg per year	Layer clouds with bases colder than +10°C and cloud top temperature colder than 0°C but warmer than –20°C. Weather forecast of KMA	March 2001 2 days	Randomized experiment Document planned EIS-Yes C/B-No
LIBYAN ARAB JAMAHIRIYA											
LI-1	Op. PE Inc.	Target area 60,000 km^2	National Cloud Seeding Research Centre	Northern Coastal areas	1980 Not implemented every year Yes	Peoples general com mittee for produc tion (G)			Tops colder than 0° but warmer than –20 °C. Seeding criteria weather radar and forecasts		Evaluation based on randomized experiment, report not available. EIS-No C/B-Yes

MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF											
MA-1	Hail Supp Op	Target area 25,000 km^2	Hail suppression project	Republic of Macedonia	1971 Every year Yes	Wea Ser (G)	Rockets release in in-cloud	AgI 400 gr	Convective clouds with temp warmer than +10°C and top colder than –20°C	April-Oct Hail supp	Comparison with historical records Doc planned EIS-No C/B-YES
MALAYSIA											
MAL-1	Op. PE (E)	Whole country No control area	Drought Operation	Whole country	1997 Every year Yes	Wea. Serv. (G)	In cloud seeding With NaCl liquid spray from 2 A/C. Seeding in moderate size cumulus (tops 10-13000 feet)	NaCl , 200 kg per day Total annual consumption : 18,000 kg	Convective clouds with bases warmer than 10°C top warmer than –20°C but colder than 0°C.	Various periods from April-November 86 days	No evaluation provision EIS-No C/B-No
MOROCCO											
MOL-1	Res Dev PE (E)	Target: 14,300 km^2	ALGHAIT	Between 31°-33° N and 5° – 7°W	1984 Every year Yes	Wea. Serv (G)	Seeding at all cloud levels from 14 G/B actone burners and 2 A/C. Seeding between –5°C to –12°C levels	AgI. Total consumption 45kg. Propane Total consumption 8750 kg	All cloud types with bases losser than 10°C and tops between 0°C and –20°C seeding criteria: wind between 240-320° LWC must be 0.1 g/m^3 for at least 10kms	Jan-April and Oct. Dec. 33 days	Evaluation based on comparison with nearby areas. Evaluation available EIS-No C/B-Yes

IV. REGISTER OF 2001 REPORTED PROJECTS

RUSSIAN FEDERATION											
RF-1	Precip. Enhanc Water Supply Aug. Incr. Precip. Wet Period Prec. Redist Res. Dev. Op	Target: 60,000 km^2 Control area 120000 km^2	Rain enhancement using aircraft with microphysical instrument tation	Southern part of Russia (Region of Stavropol and in Kalmik Republic)	1986 Every year Yes	Agr (G) Met Serv (G)	3 aircrafts. Pyrotechnic rockets, solid dry ice and liquid N dispersal. Cloud base and cloud top t –4 or –5°c	AgI 5kg/year Liquid N 500 kg/year Dry ice 1000 kg/year	Convective and stratiform clouds with CI base to warmer than 10°C CI top to less than 0oC but higher than –20°C. Microstructure of CL is measured. Radar characteristics of the cloud, Z, Z(H) and the convective instability of the atmosphere to 10°C h2km.	April-Oct 15 days per year	Compariso n with historical records report planned and available EIS-YES C/B-YES
SERBIA AND MONTENEGRO											
SM-1	Hail Supp Op	Target Area 70858 km^2	Hail supp system in Serbia	The territory of Republic of Serbia	1967 Every year Yes	Pyrotechnic rocket (Agr (P) Wea. Serv.	In cloud seeding from 4°C to 12°C	AgI 5.62 kg/units 5112.6 kg	Convective clouds colder than +10oC top temperatures colder than –20°C. Radar reflectivity log 4.5. Max radar reflectivity height above 0°C. Height of increase radar echo above –14°C and radar echo to height above –28°C.	15 April – 15 october 72 days	Comparison historical records. Crop damage Doc available in WMO. EIS-No C/B- Yes
SPAIN											
SP-1	Op. Hail	Target area: 300,000 Ha	2001 Hail suppression project in Aragon	Various towship in Zaragoza and Teruel	1970 Every year Yes	Agr (G)	G/B seeding from 93 actone burners	AgI 6.4 litres per generator. Total annual consumption 595 litres	Convective clouds with bases lower than 10°C and with tops colder than –20°C. Seeding criteria based on met forecasts of possible hail.	May-October 34 days	Evaluation based on crop damage. No report EIS-No C/B-No

IV. REGISTER OF 2001 REPORTED PROJECTS

SYRIAN ARAB REPUBLIC											
SY-1	Op PE, Inc. (R) Ext.	Target: 120,000 km^2 Variable control area	Syrian Cloud Seeding Project	Countrywide except for 10km strip from international borders	1991 Every year Yes	Agr (G) Wea Ser (G)	Cloud top and in cloud seeding from 4 A/C	Agl at various consumption rates. 701.2 kg total consumption.	Convective and orographic cloud types with bases colder than 10°C and tops colder than 0°C but warmer than –20°C. Seeding criteria based on cloud and synoptic characteristics.	Oct – Dec Jan – May 18 days	Evaluation based on comparison with historical records. Report available EIS-No C/B-Yes
UNITED STATES OF AMERICA											
US-1	PE Snow Aug men tation	435 km^2	NOAA 01-1067 02-1118	Mokalumne California		(P) Pacific Gas and Electricity Company		Agl. Total consumption 53.9 kg		Jan –April 28 days Nov-Dec 12 days	Report available
US-2	PE Snow Aug men tation	1,280 km^2	NOAA 01-1068 02-1117	Lake Almanor California		(P) Pacific Gas and Electricity Company		Ag l Total consumption 103.0kg		Jan – Apr 29 days Nov-Dec 17 days	Report available
US-3	PE Snow Aug men tation	256 km^2	NOAA 01-1074 02-1116	Central Colorado		(P) Vail associates		Agl total Consumption 20.5 kg		Jan-Feb 23 days Nov-Dec 31 days	Report available
US-4	PE Snow Aug men tation	2560 km^2	NOAA 01-1063	Northern Utah		Cache County (G)		Agl Total consumption 23.3 kg		Jan – Apr and Dec 31 days	Report available
US-5	PE Snow Aug men tation	25,600 km^2	NOAA 01-1085 02-1120	Central and Southern Utah		(P) Utah Water Resource Development Corporation		Agl Total consumption 47.6 kg		Jan – Apr 33 days Nov-Dec 11 days	Report available

IV. REGISTER OF 2001 REPORTED PROJECTS

US-6	PE Snow Aug men tation	461 km^2	NOAA 01-1080 01-1099	Wind River Wyoming		Eden Valley Irrigation and Drainage District		Agl. Total consumption 2.2 kg		Jan-Apr 2 days Nov-Dec 8 days	Report available
US-7	PE	1603 km^2	NOAA 01-1077 01-1128	Santa Barbara California		Santa Barbara County (G)		Agl. Total consumption 10.8 kg		Jan – March 9 days Dec 9 days	Report available
US-8	PE Snow Aug men tation	8,235 km^2	NOAA 01-1070 02-1101	Nevada Carson Walker Project		State of Nevada (G)		Agl Total consumption 25.4 kg		Jan-April 30 days Nov-Dec 14 days	Report available
US-9	PE Snow Aug men tation	2,790 km^2	NOAA 01-1071 02-1102	Truckee Tahoe Project Nevada		State of Nevada (G)		Agl, Total consumption 17.4 kg		Jan-Sept 27 days Nov-Dec 11 days	Report available
US-10	PE	10,240 km^2	NOAA 01-1089	Colorado River Texas		Colorado River Municipal Water District		Agl. Total consumption 6.1 kg		Apr-Oct 21 days	Report available
US-11	PE Hail	3,809 km^2	NOAA 01-1096	North Dakota District I		N. Dakota atmospheric Research Board		Agl. Total consumption 0.03 kg		June – August 27 days	Report available
US-12	PE Hail	22,920 km^2	NOAA 01-1097	North Dakota District II		N. Dakota atmospheric Research Board		Dry ice. Total consumption 1808.6 kg		June-August 33 days	Report available
US-13	PE Hail	30,756 km^2	NOAA 01-1090	West Kansas		W. Kansas groundwater		Agl and dry ice. Total consumption 119.2 kg and 790.9 kg, respectively		Apr-Sept. 61 days	Report available

US-14	PE	1,152 km^2	NOAA 01-1056	Eastern Sierra California		Los Angeles City		Agl. Total consumption 31.8 kg		Jan-Dec 32 days	Report available
US-15	PE	1,280 km^2	NOAA 01-1057	Kaweah River California		Kaweah Delta Water Conservation District		Agl. Total consumption 17.7 kg		Jan – Dec 35 days	Report available
US-16	PE	3,072 km^2	NOAA 01-1058	Kern River California		North Kern Water Storage district		Agl. Total consumption 13.4 kg		Jan-Dec 40 days	Report available
US-17	PE	4,096 km^2	NOAA 00-1059	Kings River California		Kings river conservation district		Agl. Total consumption 36.5 kg		Jan – Dec 42 days	Report available
US-18	PE Snow aug men tation	880 km^2	NOAA 01-1081	Clark county, Idaho		Mud Lake Water Users		Agl. Total consumption 7.4 kg		Jan-March 23 days	Report not available
US-19	PE	3072 km^2	NOAA 01-1060	San Joaquin River California		(P) Southern California Edison Company		Agl. Total consumption 48.2 kg		Jan-Dec 73 days	Report available
US-20	PE	3,072 km^2	NOAA 01-1061	Tuolumne River California		Turlock Irrigation District		Agl. Total consumption 2.0 kg		Jan-Dec 24 days	Report available
US-21	PE Snow aug men tation	1,216 km^2	NOAA 01-1072 02-1103	Nevada Tuscarora		State of Nevada (G)		Agl. Total consumption 16.6 kg		Jan-Apr 27 days Nov-Dec 11 days	Report available
US-22	PE Snow aug men tation	1,220 km^2	NOAA 01-1073 02-1104	Nevada Toiyabe		State of Nevada (G)		Agl. Total consumption; 6.8 kg		Jan-Apr 20 days Nov-Dec 11 days	Report available
US-23	Fog	51 km^2	NOAA 01-1098	Salt Lake City Airport		Delta Airlines		Agl. Total consumption 3.8 kg		Oct-Dec 14 days	Report available

IV. REGISTER OF 2001 REPORTED PROJECTS

US-24	PE	46,848 km^2	NOAA 02-1105	High Plains Texas		High Plains Under ground water conservation		Agl. Total consumption 66.2 kg.		Apr-September 44 days	Report available
US-25	PE Hail	178,950 km^2	NOAA 01-1088	Oklahoma		Oklahoma Wea. Mod		Agl. Total consumption 480.6 kg		Mar-June 45 days	Report available
US-26	PE	16,128 km^2	NOAA 01-1090	Texas Panhandle		Panhandle groundwater conservation		Agl. Total consumption 12.5 kg		Apr-Sept 31 days	Report available
US-27	PE Snow Aug men tation	25 km^2	NOAA 02-1106	Alta/Snowbird Utah		Snowbird Ski Resort (P)		Agl Total consumption 3.1 kg		Oct-Dec 17 days	Report available
US-28	PE Snow aug men tation	8,166 km^2	NOAA 01-1069 02-1110	Ruby mountains, Nevada		State of Nevada		Agl 27.2 kg		Jan-April 31 days Nov-Dec 14 days	Report available
US-29	PE Snow aug men tation	881 km^2	NOAA 02-1123	Mud Lake Water users		Mud Lake, Water users		Agl, total consumption 3.5kg		Dec 11 days	Report available
US-30	PE	1024 km^2	NOAA 01-1065 02-1107	San Gabriel Mountains California		Municipal		Agl. Total consumption 4.4 kg		Jan-Apr 13 days Nov-Dec 4 days	Report available
US-31	PE Snow Aug men tation	154 km^2	NOAA 01-1075 02-1114	Telluride San Miguel Colorado		Telluride Ski and Golf Co. (P)		Agl. Total consumption 7.0 kg		Jan and Nov-Dec 33 days	Report available
US-32	PE	604 km^2	NOAA 01-1076 02-1121	Sacramento County, California		Municipal		Agl. Total consumption 11.7 kg		Jan-May Nov-Dec 28 days	Report available
US-33	PE Hail	22,259 km^2	NOAA 01-1086	Southwestern Texas		Wintergarden groundwater		Agl. Total consumption 94.0kg and 1263 kg of dry ice		Apr-Nov 48 days	Report available

IV. REGISTER OF 2001 REPORTED PROJECTS

US-34	PE	25,510 km^2	NOAA 01-1087	Texas Edward Aquifer Precipitation		Edwards Aquifer Authority		Agl. Total consumption: 21.7 kg		April-September 35 days	Report available
US-35	PE Snow Aug men tation	435 km^2	NOAA 01-1082 02-1102	Grand Mesa Project Colorado		Water Enhancement Authority		Agl. Total consumption 2.2 kg		Mar Apr, Dec 4 days	Report available
US-36	PE Snow augm entati on	1,641 km^2	High plains Enhancement NOAA 02-1125	Eastern Counties Idaho		Let it snow (P)		Agl. Total consumption 3.7 kg		Dec 9 days	Report available
US-37	PE Snow augm entati on	384 km^2	02-1126	Cache county, Utah		Municipal		Agl. Total consumption 5.7 kg		Dec 9 days	Report available
US-38	PE Snow Aug men tation	2560 km^2	NOAA 01-1064	Utah Western Unitas		Weber basin water conservation		Agl total consumption 23.2 kg		Jan-April 29 days Dec 4 days	Report available
US-39	PE	38,400 km^2	NOAA 02-1132	West Texas		West Texas Weather Modification		Agl. Total consumption 104.3 kg		March-Dec 39 days	Report available
US-40	PE	471,040 km^2	NOAA 01-1079 02-1124	District V, Idaho		Oneida county				Jan-April Nov-Dec	Report available
US-41	PE Snow augm entati on	1536 km^2	NOAA 02-1115	Purg. West San Juan, Colorado		Municipal		Agl. Total consumption 10.3 kg		Nov-Dec 26 days	Report available
US-42	PE Snow augm entati on	128 km^2	NOAA 01-1084	Emery water Conservatory, Utah		Emery water conservatory		Dry ice. Total consumption 548.6 kg		Jan-March 18 days	Report available
US-43	PE	16,602 km^2	NOAA 01-1093	N. Plains, Texas		N. Plains groundwater		Agl. Total consumption 9.9 kg		Apr-September 27 days	Report available

US-44	PE	22,397 km^2	NOAA 01-1095	W. Central Texas		Weather Modification, Inc		AgI, Total consumption 47.7 kg		June-Oct 34 days	Report available
US-45	PE Snow augmentation	8,960 km^2	NOAA 02-1119	Boise river, Idaho		Boise project Board of control		AgI. Total consumption 6.9 kg		Nov-Dec 20 days	Report available
US-46	PE	38,400 km^2	NOAA 02-1132	West Texas		West Texas Weather Modification		AgI. Total consumption 104.3 kg		March-Dec 39 days	Report available
US-47	PE	21,609 km^2	NOAA 02-1134	West Texas		West Central Texas Weather Modification		AgI. Total consumption 0.05 kg		June-Oct 36 days	Report available
US-48	PE		NOAA 02-1138	South Texas		South Texas Weather Modification		AgI. Total consumption 30.2 kg Dry ice. Total consumption 218.2 kg		Jan-Dec 26 days	Report available
US-49	Hail	10 km^2	NOAA 02-1142	Belding Farm, Texas		Agr (P)		Dry ice. Total consumption 1.8 kg		June-September 5 days	Report available
US-50	Hail	3 km^2	NOAA 02-1143	Powell Farm Texas		Agr (P)		Dry ice. Total consumption 1.8 kg		Aug-September 4 days	Report available
UZBEKISTAN											
UZ-1	Op. Res Hail	Target area: 7,380 km^2	Hail suppression project	Fergan Valley, Surhardaryn, Kashkadaryn and Samarkand regions	1969 every year	Agr (G)	In-cloud seeding with rockets with pyrotechnic flares. Seeding in layer from –6°C to –30°C	AgI at a rate of 20g/km^3 total consumption: 17.2 kg	Convective clouds with bases warmer than 10°C and tops warmer than –20°C but colder than 0°C. Seeding criteria based on presence of Cb clouds, cloud top heights, radar reflectivity heights of –6 and –10°C levels	Apr-Aug 18 days	Evaluation based on comparison with historical records. Report available EIS-No C/B-Yes

V. ADDRESSES OF REPORTING AGENCIES

ARGENTINA	IDEPRN Facultad D'ingeneria Universidad Nacional de Cuyo CC 405 CP 5500 MENDOZA
AUSTRALIA	Hydro Tasmania P.O. Box 355 HOBART, Tasmania 7001
AUSTRIA	Central Institute of Meteorology and Geodynamics Department of Climatology Hohe Warte 38 A-1190 VIENNA
BULGARIA	National Institute of Meteorology and Hydrology Bulgarian Academy of Sciences 66, Tsarigradsko Chaussee SOFIA 1784
CANADA	Alberta Severe Weather Management Society 600, 708 – 11th avenue, SW CALGARY, Alberta T2R 0E4
CHILE	Direccion Meteorologica de Chile Departamento de Meteorologia Applicada Casilla 63, Aeropuerto Internacional Arturo Merino Benitez SANTIAGO
CHINA	China Meteorological Administration 46 Baishiqiaolu Road BEIJING 100081
CROATIA	Meteorological and Hydrological Service of Croatia Department of Hail Suppression 3, Gric ZAGREB 10000
FRANCE	Association Nationale d'Etude et de Lutte contre les Fléaux Atmosphériques 52 rue Alfred Duméril 31400 TOULOUSE ACMG Aérodrome d'Agen 47520 LE PASSAGE
GERMANY	Landratsamt Rosenheim 53, Wittelsbacherstrasse 83022 ROSENHEIM

GREECE	Hellenic Agricultural Insurance Organization 45 Mesogion Street P.O. Box 14103 11510 ATHENS
HUNGARY	Hungarian Meteorological Service P.O. Box 38 H-1525 BUDAPEST
IRAN, ISLAMIC REPUBLIC OF	National Cloud Seeding Research Centre NACSER P.O. Box 89195-611 YAZD
ISRAEL	Israel Meteorological Service Rain Enhancement Division P.O. Box 20 BEN GURION AIRPORT 70100
JAPAN	Japan Meteorological Agency Meteorological Research Institute Nagamine 1-1 TSUKUBA, Ibaraki 305-0052
LIBYAN ARAB JAMAHIRYA	General Transport and Communication Meteorological Department Cloud Seeding Administration P.O. Box 5069 TRIPOLI
MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF	Hydrometeorological Service Skupi BB P.O. Box 218 1000 SKOPJE
MALAYSIA	Malaysian Meteorological Service Ibu Pejabat Kajicuaca Jalan Sultan 46667 PETALING JAYA
MOROCCO	National Meteorological Service BP 8106 Casa Oasis CASABLANCA
RUSSIAN FEDERATION	Russian Federal Service for Hydrometeorology and Environmental Monitoring 12 Novagankovsky street 12 MOSCOW 123242
SERBIA AND MONTENEGRO	Republic Hydrometeorological Service of Serbia Kneza Viseslava 66 P.O. Box 100 BELGRADE

SPAIN	Gobierno de Aragon Centro de Proteccion Vegetal Apartado 727 500080 ZARAGOZA
SYRIAN ARAB REPUBLIC	Meteorological Department Rain Enhancement Project Joul Jammal Street P.O. Box 4211 DAMASCUS
UNITED STATES OF AMERICA	National Oceanic and Atmospheric Administration National Weather Service 1325 East-West Highway SILVER SPRING, MD 20910 3283
UZBEKISTAN	Main Administration of Hydrometeorology 72 Makhsumov st. 700052 TASHKENT

VI. MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

Page

VII: MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
ARMENIA				
Armenia all types of terrain in Lake Sevan basin Hail-10,040 km^2 target area and 4000 km^2 control area PE – 4170 km^2 target area and 2000 km^2 control area	Hail suppression and precipitation enhancement Hail 1964 – 91 PE 1970 -90	Agl. Ground based seeding with 3 generators, 2A/C for PE, rockets and artillery shells for hail. 3 year experiment using super meteoron for PE conducted. Pyrotechnic flares and solid dispersal. Seeding at –6 ± 3°C level for hail. Convective clouds (hail) and orographic and layer clouds for PE. Bases colder than 10°C tops warmer than –20°C (PE). Radar reflectivity and cloud thickness greater than 2 km (hail) There were 12 anti-hail teams equipped with radars and 55 missiles sites	Evaluation based on randomization (PE) and comparison with historical records, crop damage and hail pads. EIS-Yes C/B-Yes	R.S. Ovsepyan Armenhydromet Centre for Weather Modification Leo Str 54 Erevan 375002 Armenia
AZERBAIJAN				
Azerbaijan. 13,000 km^2 target area. Fixed. Mountainous terrain	Hail suppression. 1967-1992 April - October	In-cloud seeding between –6°C to –12°C level in convective clouds using Agl and pyrotechnic flares using rockets, artillery shells and explosives		S.A. Kerminov National Hydrometeorological Service 370154 Baku MOSCOVSKY PROSPEKT 50
CHINA				
Henan Province, flat terrain 160,000 km^2 target area. Cross over basic design with fixed area. Instrumented with 138 recording raingauges	Hail suppression and precipitation enhancement and their experimental basis March-May and Sept-Oct.	Agl. Cumulus stratiform and frontal clouds. Seeding from G/B and airborne generators. Seeding at 5000 m at 0.3 kg/hr over 8 km. Exp units, radar >25 dbz, temp in cloud from –5 to –15°C, e-ei >0. Unrestricted randomization with 1-2 hrs being standard seeding unit.		Weather Modification center of Henan Henan Province 110 Jinshui Road Zhengzhou city Henan

Hebei Province. All types of terrain. Basic design: cross over with variable area definition. 60,000 km^2 target and control area. Instrumented with 70 recording raingauges.	PE (rain and snow) and hail suppression. From 1990-2005, March-October	AgI. Airborne seeding between 4000-6500 m over 1200 kms a 0.5 kg/hr. Exp. Unit: duration of unit 3 hours with seeding dependent on LWC and cloud top and base temperatures restricted randomization. Qualitatively more precipitation and less hail mass.		Prof. Duan Ying Hebei Weather Modification office 050021 Hebei Province
Jilin Province. Hilly and flat terrain. Basic design: target only with fixed area definition. 800 kms between areas. Target area, 121,000km^2. Instrumented with 80 manual and automatic gauges.	PE and hail suppression from 1958-2001 (April-Sept)	AgI and dry ice. Both G/B and airborne generators with 152 on ground seeding altitude 6000 m for 800 km at 0.25 kg/hr (AgI) and 25kg/h (dry ice). Randomization unrestricted. More precipitation qualitatively observed.		Weather modification office. Jilin province Heping street 7 Changchun 130062 Jilin Province
Qing Hai province. Mountainous terrain. Basic design: target only with fixed area definition. 27 gauges in target area and 20 in control area. Target area 75,000km^2 control area 50,000 km	PE in upper reaches of yellow river and areas around Ringhail lake. Duration 5 years (June-September)	AgI. Both G/B and airborne generators seeding between 4500 and 6000 m for 2 km at 1000 g/h		Dr Auping Sun Weather Modification office Wusi street No. 19 Xining 81001 Qinghai Province
JORDAN				
14,500 km^2 target area in hilly and flat terrain. Cross over and 10 sub-divisions	PE from mid-october – mid-May each year. Has been conducted from 1986 up to May 2000.	G/B and airborne seeding with AgI on all types of clouds and using 25 G/B generators. Seeding track 100 km at 420 g/hour. Experimental unit 120 days seeding between -5^0 and -10^0C levels of clouds with low number of ice particles. Standard seeding period about 60 hours. Qualitative results indicate more precipitation. Quantitative show 15-19% increase at 0.05 statistical significance.		M.I.K. Tahboub Meteorological Department Ministry of Transport P.O. Box 341011 AMMAN 11134 Jordan

VII: MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

LIBYAN ARAB JAMAHIRIYA				
Libya, Tripoli – Sert – Elmarg. mountainous and flat. Fixed target and control areas. Area definition variable depending on suitability of clouds. Cross over. Target area 60,000 km^2	Cold cloud seeding to increase precipitation during winter period. (October-March). 21 years.	Airborne seeding of cumulus clouds using AgI above 3000 meters cumulus. Seeding rate variable and length of seeding track 150 kms. Meteorological Service raingauges. Standard seeding period not service specified. Unrestricted randomization and daytime seeding, quantitative and qualitative results not specified.		National center for cloud seeding research Tripoli airport.
MOROCCO				
Morocco between 31°-33°N and 5-7°W in mountainous terrain. Target only. Fixed 14,300 km^2	PE-snow from Nov-April began 1984-present project known as AlGhait.	AgI. G/B and airborne seeding from 14G/B generators. 17 precipitation gauges and 1 recording gauge. Other verification accomplished by radar reflectivity. Results tested by statistical, physical and chemical methods. Qualitative tests indicate increased precipitation: seed/no seed ratio 17% 800 mill m^3 from 1986-91.		National Meteorological Service BP 8106 Casa Oasis CASABLANCA
SYRIAN ARAB REPUBLIC				
Target area 120,000km^2 All types of terrain. Basic design: target and control, cross over with variable area definition. Project activitiy covers all of Syria.	PE-To improve distribution of rainfall from October-May. Project duration 11 years.	AgI. Seeding all cloud types between 4500-7000 m. Length of seeding track variable and seeding rate 5.5 kg/hour. 160 raingauges employed with 36 being recording rangauges. Other verification quantities based on radar reflectivity and cloud measurements. Standard seeding period varies according to cloud formation, extent and specification. Determination whether clouds seedable or not based on agreed seeding parameters. Tests ratio method, floating control and comparison with historical series. Results variable from month to month but globally positive. Seed/no seed ratio 104.8%. Basis for results. 45 days experiment during 1991 to determine cloud specifications and appropriate techniques.	1. Sixth WMO Scientific Conference on Weather Modification, Paestrum, Italy, 30 May-4 June 1994. WMO/TD No. 596. 2. Seventh WMO Scientific Conference on Weather Modification, Chiang Mai, Thailand, 17-22 February 1999, WMO/TD No. 936. 3. Evaluation of precipitation enhancement activities in Syria, 2001-2002 season	Precipitation enhancement project in Syria Department, Ministry of Agriculture Damascus

VII: MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

UZBEKISTAN				
Uzbekistan mountainous terrain, 7380 km^2 target area. Target only. Fixed area.	Hail suppression to protect agriculture. 32 years from April-August.	AgI seeding of cumulus clouds. 58 raingauges in target area. Other verification quantities include radar reflectivity and journeys round hail affected area to assess damage and size of hailstones. Seeding based on radar and need for reflective area to be greater than 2.5 km deep. 44 units seeded with 30 for hail and 14 aimed at interrupting showers. Seeding period 2-30 minutes, max 1.5 hours. Project results based on diminution in radar reflectivity and the visual characteristics of clouds. Results of each test determined from extent of hail damage to crops. No statistical significance was determined. Work was done on the effect of the anti-hail system on the precipitation scheme. None was discovered. Seeding was carried out using unguided reactive devices from the ground.	Systematic recommendations on forecasting hail, intensity Comp. R.G. Shadyyev, Kh. A. Tmamjanov, Tashkent, 1987-17 c) Kh. A. Tmanjanov, Parametrical model of hail bearing thunder clouds goskomhydromet 1984, 100/181 pp36-40. B.A. Kamalov, V.V. Sabayev, S.V.Usmakov,. An evaluation of the effect of the anti-hail system on the precipitation scheme in the Terganskaya valley. Works of the scientific research institute of meteorological information, Goskomhydromet 100 (181) pp-56-75. Kh A. Tmanjanov: Hail and hail damage in North east Uzbekistan, works of SRTMT, 1990 110 (191) pp 87-95	Weather modification agency Glavgidromet Tashkent

VIII. MEMBER COUNTRIES REPORTING *NO* WEATHER MODIFICATION PROJECTS IN 2001

Belize
Colombia
Czech Republic
Democratic Republic of Congo
Denmark
Dominica
Dominican Republic
Finland
Georgia
Guyana
Iceland
India
Kenya
Latvia
Lithuania
Mali
Mauritius
Myanmar
New Zealand
Republic of Yemen
Senegal
Singapore
South Africa
Sweden
Switzerland
Turkey
United Republic of Tanzania
Venezuela

III. MEMBER COUNTRIES REPORTING 2002 PROJECTS

Page

IV. REGISTER OF 2002 REPORTED PROJECTS

ARGENTINA											
AR-1	Hail suppression Res. Op.	Target area 3200 km^2 Control area 4500 km^2	Mendoza hail suppression programme	Mendoza	1999 6 months by year (Oct-March) Yes	Agr (G) Res. Found (G) Univ.	4 aircrafts Pyrotechnic flares Cloud base, cloud top, in cloud between –5°C, -10°C	AgI 40,000 flares x 20 g And 2000 bips by year (mean of 4 year) 1200 kg each year (means between 1999-2003)	Convective clouds warmer than +10°C Cloud top colder than –20°C. Microstructure unseeded cloud measured. All clouds are seeding	Since October until March between 1999-2003 60 by year	Comp Historical records Crop damage Doc planned and available EIS-Yes C/B-Yes
ARMENIA											
ARM-1	Prec. Enh Inc. Res. Op.	Target area 4170 km2 Prec. Enhancemt 100040 km^2 Hail supp	Sevan basin	Lat 39°40' 41°18' Long 43°40' 45°36'	Hail supp 1964-1991 Precipitation Enahcement 1970-1990 Every year Yes	Agr (G) Wea. Serv	3 ground generators 2 aircraft Experiments were made on precipitation enhancement over 3 years using a super computer	Ag I Pyrotechnic flare	Convecitive clouds and orographic colder than +10°C tops colder than 0°C warmer than 20°C	April to October 200 days	Randomized experiment Comparison Historical records Doc available EIS-YES C/B-Yes
AUSTRALIA											
AUS-1	PE Inc. Op.	Target area 8233 km^2	Tasmanian Area cloud seeding operation 2002 (TASCO 2002)	Tasmanian central highlands	1998 Sept-Every year Yes	Energy (G)	Aircraft acetone burner seeding in cloud at –10°C level or cloud tops warmer than –10°C.	AgI at 385 g/hr 17.4 kg /year AgI smoke generator used each consuming 192g/hr	Layer clouds with bases colder than 10°C and tops colder than 0°C but warmer than –20°C. Supercooled water content 0.1 g/m^2. Cloud depth >1/2 . Wind speed < 75 lat cloud top temp colder than –5°C.	April-Nov. 34 suitable seeded days	Evaluation based on results of 25000 ft joint HEC/CSIRO randomized. Trial of 79-83 inclusive.

IV. REGISTER OF 2002 REPORTED PROJECTS

AUSTRIA											
AU-1	Op. Hail Supp.	Project target area 500 km^2	Hail test project lower Austria	48°15 – 48°30 15°20N – 15°50E	1981 Every year Yes	Agr (P)	3 A/C with acetone burners and pyrotechnic flares for seeding cloud bases	AgI 11/hour annual consumption 34kg criteria	Convective clouds; bases colder than +10°C and tops colder than –20°C: Subjective support regional weather forecasts and C-band radar data	April-August 16 days	Evaluation based on historical records crop damage and hail pad data. Report available EIS-No C/B-No
AU-2	Op. Hail	1800 km^2	Hail test project Styria	46°30 – 47°15 15°30N – 16°00E	1985 Every year Yes	Agr (P)	3 A/C with acetone burners and pyrotechnic flares for seeding cloud bases	AgI 11/hour annual consumption 94kg support	Convective clouds; bases colder than +10°C and tops colder than –20°C: Subjective criteria support regional weather forecasts and C-band radar data	April-August 30 days	Evaluation based on historical records crop damage and hail pad data. Report available EIS-No C/B-No
BULGARIA											
BG-1	Op. Res. Hail Supp.	15,670 km^2	Bulgarian Hail supresión project	NW Bulgaria 43° 20– 44°0 22°30N – 24°40E South Bulgaria 42°-42°35'N 24'00 – 26°30'E	1969 Interrrupted Yes	Agr (G)	Rocket-based pyrotechnic flares for in cloud seeding at temperatures –5 to –12°C.	AgI 43 g/rocket	Convective clouds; bases warmer than +10°C and tops colder than –20°C: Seeding criteria based on radar echo, cloud heights or cloud top temperature and reflectivity.	May-Sept.	Evaluation based on comparison with historical records crop damage. Evaluation document done but not available to WMO. EIS-No C/B-Yes

IV. REGISTER OF 2002 REPORTED PROJECTS

BURKINA FASO											
BF-1	Prec. Enh. Emer Inc. Precip. Redis. Res. Dev. Op.	Target area 27000 km^2	Programme SAAGA	9°N 16°N 3°E et 6°W	1998 Not every year Yes	Agr (G) Hyd (G)	20 ground generators 3 aircrafts actone burner seeding cloud base, ground and cloud top	Acetone 1460 l annual consumption. Flares burn places 197 kg/year Iodure d'argent 4 kg/year flares expertatiles 718 kg/year flares hygros-copiques 197 kg/year	Convective clouds Cloud base temp. Warmer +10oC top colder than 0oC but warmer than –20oC	July-October 120 days	Documentation planned EIS-No C/B-No
CANADA											
CAN-1	Op. Hail	26,000 km^2	Alberta hail suppression project	Province of Alberta (Lacombe to High River). Priority given to cities of Calgary and Red Deer.	1996 Every year Yes	Ins.(P)	3 aircrafts generator with acetone burner pyrotechnic flare. Seeding cloud based and cloud top between –8°C and –15°C.	Agl. Flares: one 20g every 5 sec. In cloud top and 150 g flare. Annual consumption 124,2 kg.	Convective clouds; bases colder than -10°C and tops colder than –20°C: Seeding criteria: radar defined cells with max. reflectivity 40 dbz, extending above 3 kms and > $10km^3$	1 June – 15 Sept. 27 days.	Evaluation based on comparison with historical records. Document available. EIS-No C/B-Yes

CHILE											
CHL-1	Prec Enh Water supply augm Inc. Op.	Project area 1000 km^2 Control area 160 km^2	Programa de Rstimulacion de Precipitatione s Cuenca del Cachapoal VI Region	Cuenca del Rio Cachapoal, ubicada en la VI Region de Chile Lat: 34°00' S a 34°20'S Long : 70°20' W a 70°45'W	2000 Every year Yes	Agr (G)	Ground seeding. 8 generators Generators with acetone burners. Release is in ground	.AgI 9990 g 11.8 kg/year	Convective, orographic, layer clouds warmer than +10°C and colder than –20°C. Presencia en el sector de perturbaciones atmosféricas, tales come Frentes y Núcleos frios en altura. La red se activa en sectores de la cuenca cuando comenzaba a producirse precipitations	1 April to 30 Sept. 2002 25 days	Comparison with historical records. El sistema de evaluacion de los resultados obtenidos en el programa se baso en la comparación del comportamiento promedio o historico de la precipitación, tanto de la cuenca como fuera de ell, para posteriormente comparar ese comportamiento historico, llibre de los efectos de la estminulacion, versus el comprtamiento del ano 2002, bajo el programa de estmimulacion Doc available in WMO EIS-No C/B-Yes
COLOMBIA											
COL-1	Preci Enh Emer Op	Target area 50 km^2 Control area 100km^2	Bombardeo de Nubes Para Producción de Lluvia sobre los embalses de la Sabana de Bogota	Los Niveles de los embalses dsminuyeron (1988) como consecuencia de la sequia causada por el fenómeno el nino de 1987. Hubo Racionamiento de agua en bogota por ese motivo	1988 Every year Yes	Ener(G)	1 aircraft artillery shells Release is in cloud		Layer clouds with temp Colder than +10°C. Tops colder than 0°C but warmer than –20°C	March-April 1988 45 Days	No evaluation EIS/No C/B-No

IV. REGISTER OF 2002 REPORTED PROJECTS

FRANCE											
FR-1	Op. Res. Hail Supp.	Target area 80x40 km^2	Hail suppression programme using Ag-I rockets	North of Gers (8 canton)	2000 every year Yes	Agr (P) AEECNG	Seeding rockets explosive generator cloud base seeding material.	AgI Depending on the size of the cloud.	Convective clouds; (cumulocongestus and cumulonimbus) colder than +10°C and cloud top colder than –20°C. Microstructure unseeded cloud measured with TITAN but no aerosols.Risks of thunderstorms delivered by Meteo-France radar with TITAN allow to decide which cell has to be treated when the hail risk is confirmed in the zone.	May until September 2002. Average 15 days.	Hail pads. Report planned not available EIS-No C/B-YES
FR-2	Op. Res. Hail Supp. Frost	Target area 80x40 km^2 Control area 100x60 km^2:	Test de lutte antigrêle utilisant sels hygros-copiques	Department Tarn et Garonne. Montauban	1995 Every year yes	Agr (P) AEAG	1 aircraft cloud base and pyrotechnic flare generator.	NACl – 2 flares of 1kg every 4mn. 160 kg	Convective clouds. Cumulo congestus and cumulonimbus colder than +10°C Tops colder than –20°C	20th April – 30th September 2002. Averages 15 days.	Hail pads. Comparison to non seeded cells with TITAN. Doc available in WMO. EIS-YES C/B-YES
FR-3	Hail supp Res. Op	Target area 60000 km^2 Control area 420000k m^2	ANELFA Association Nationale d'Etude et de lutte contre les fléaux Atmosphériques	Bassin Aquitain, Bassin Rhodanien Vallée de la Loire	1952 Every year Yes	Agr Asso ciation depar tementale	Ground seeding 675 generators Acetone burner Ground seeding dispersal	AgI 8 g /hours/ generators 493 kg per year	Convective clouds. Temp warmer than +10°C and tops colder than –20°C Prévision des chutes de grêle au sol pouvant provoquer des dommages aux cultures.	15 April – 15 October 51 days	Hail pads Doc available In WMO EIS-Yes C/B-No

IV. REGISTER OF 2002 REPORTED PROJECTS

GERMANY											
GER-1	Hail Supp Res Op.	Target area 4400 km^2	Halgelab wehr Hagel forschung Rosenheim	Mountainous to hilly terrain from 1900 MSL to 500 MSL on Northern Side of Alps	1975 Every year Yes	County	2 aircrafts with acetone burner seeding at cloud base	AgI 6l/hour 40 kg	Convective clouds cloud base warmer than +10°C tops colder than –20°C temp.advection, vertical windspeed humidity altitude of troposphere radar echos infrared satellite photos.	1.5.2002 to 30.9.2002 24 days	Doc of hail fall document planned available EIS-No C/B-No
GREECE											
GR-1	Op. Res. Hail Supp	2,350 km^2 Target area	Hellenic National Hail suppression project	NW Greece	1984 Interrupted Yes	Agr (G)	2 aircraft. Hail sound canons and sound shock waves.	AgI 240g/min 58.1 kg	Convective and orographic clouds with bases colder than 10°C and tops colder than –20°C. Seeding criteria cloud tops at least 5 km and radar reflectivity at least 35 dbz.	April – Sept. 37 days	Evaluation based on comparison with historical records, crop damage and hail pads. Evaluation available EIS-Yes C/B-Yes
HUNGARY											
HU-1	Op. Hail	Target 10,000 km^2	NEFELA Hail Suppression Associaiton	Baranya Somogy Tolna counties	1991 Every year Yes	Agr (G) (P)	Ground based seeding using 104 acetone burners.	AgI 8 gr/l Total consumption 160 Kg	Convective clouds with bases warmer than +10°C, tops both warmer and colder than –20°C. Radar reflectivity > 30dbz and height 30 dbz> hoc+2km.	May-Sept. 54 days	Comp with historical records-Crop damage No doc. EIS-No C/B-YES

IV. REGISTER OF 2002 REPORTED PROJECTS

INDONESIA											
IND-1	Prec Enh Redist Op	Agriculture fields.5000 km^2 in west Java and 9000 km^2 in central Java	Weather Mod to speed up planting season in Cimanuk and Cisanggaru Catchment Area and Weather Mod to reduce flood risk in Jakarta Province.	Cimanuk and Cisanggaru Catchment area, West Java and Central Java Province Jakarta province	1997 Every year Yes	Agr(G) Forestry (G) Hyd (G) Ener (P)	2 aircraft Cloud top seeding	NaCl 900 kg/sorty 60,000 kg this year CaO 900 kg/sorty 60,000 kg this year	Convective and orographic and layer clouds Temp warmer than +10°C and top colder than 0oC but warmer than –20°C	Oct-Feb 2002 35 days	Comparison with historical records EIS-Yes C/B-Yes
IRAN, ISLAMIC REPUBLIC OF											
IR-1	Prec Enh Water Suplf Auge Op	Target and control area 300 km radius	Yazd 2001	Central Iran Yazd Kerman Esfahan Chaharmahal	2001 Yes	Energy	1 aircraft explosive cloud top and in cloud seeding	AgI 5.4 kg/year	Convective Orographic layer clouds Colder than +10°C Top temp Colder than 0°C but warmer than –20°C suitable cloud coverage	Jan-Feb-March 90 days	Comparison Historical records Document planned EIS-No C/B-No
ISRAEL											
IS-1	Op. PE Res. Dev.	Target 400 km^2 Control 50 km^2	Israel rain enhancement project	Northern Israel	1960 Every year Yes	Hyd (G)	35 G/B acetone burners and 2 A/C with acetone burners seeding at cloud base	AgI 500 g/hour flight. Total consumption 250 kg	Convective clouds with bases colder than 10°C, tops colder than 0°C but warmer than –20°C. Microstructure of unseeded clouds measured. Seeding criteria cloud tops below –8°C and wind direction	Dec 2001 April 2002	Evaluation based on historical records. Document available EIS-No C/B-Yes

IS-2	Prec Enh Res. Op	Target area 5000km2 control area 1500 km2	Israel enhancement project	Northern Israel	1960 Every year Yes	Hyd (G)	35 ground generators 5 aircraft acetone burner for seeding cloud bases	Ag I Ground burner Aircrafts 500 gr/hr 300 Kg/year 250Kg/year	Convecitve and orographic clouds colder than +10°C tops colder than 0°C but warmer than –20°C Cloud top temp below –8°C and suitable wind direction	Nov-April 100 days	Comparison historical records Doc planned EIS-No C/B-Yes
JAPAN											
JP-1	Prec. Enhan Cement Water Supply Aug. Inc. Prec. Red. Res.	Target Area 500 km^2		Niigata and Gunna prefectures	1994 Every year Yes	Wea. Ser (G) Hyd.(G)	2 aircrafts cloud top seeding solid dispersal	Dry ice 10-30 g/sec Total consumption 1500 kg	Orographic clouds with bases colder than 10oC and top temp colder than 0°C but warmer than –20°C. Seeding criteria cloud top temp > -20°C, horizontal uniformity of clouds and liquid water path > 0.2 mm	Dec 2002 3 weeks	Report available in WMO EIS-No C/B-Y
KOREA, REPUBLIC OF											
KO	Prec Enh Water Supply Aug Dev	Target area 400 km^2	Development of weather modification techniques in Korea	Kyungnam Province	June 2000 Every year Yes	Wea Ser (G)	2 aircrafts generators with pyrotechnic flare and solid dispersal seeding in cloud temp –4°C	AgI 4g/min 0.6 kg per year 12g/sec 80kg per year	Layer clouds Temperature colder than +10°C and top colder than O°C but warmer than –20°C Weather forecast of KMA	March 2002 2 days	Randomized experiment Documentation planned EIS-Yes C/B-No
MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF											
MA-1	Hail Supp Op	Target area 25,000 km^2	Hail suppression project	Republic of Macedonia	1971 Every year Yes	Wea Serv (G)	Rockets Release in in-cloud	AgI 400 gr	Convective clouds with temp warmer than +10°C and top colder than –20°C	April-Oct Hail supp	Comparison with historical records Doc planned EIS-No C/B-Yes

IV. REGISTER OF 2002 REPORTED PROJECTS

MALAYSIA											
MAL-1	Op. PE (E)	Whole country No control area	Drought operation	Whole country	1997 Every year Yes	Wea. Serv. (G)	In cloud seeding with liquid spray from 2 A/C. Seeding in moderate size cumulus (tops 10-1200 feet)	NaCl, 200 kg per day Total annual consumption 38,000 kg	Convective clouds with bases warmer than +10°C, tops colder than 0°C but warmer –20°C 5,000 ft to 9,000 ft	Various periods from Feb – November 192 days	No evaluation provision EIS-No C/B-No
MOROCCO											
MOR-1	PE E Prec Inc. Res. Op.	Target 14,300 km^2	ALGHAIT	Haut Atlas Between 31°-25° 32°50 N and 5° 25 and 7°W	1984 every year Yes	Wea Serv (G)	Ground seeding Cloud top material 15 generators 2 aircrafts	AgI 20g/l acetone. Total consumption 56 kg.	Convective clouds and orographic cloud base T° colder than +10°C. Colder than 0°C but warner than – 20°C.	1er Nov 2002 – 30 April 2003. 27 jours	Evaluation with historical records. Document available EIS-Yes C/B-Yes
ROMANIA											
ROM-1	Hail Supp Res		National Hail suppression system		2000 Every year Yes	Agr (G)					

IV. REGISTER OF 2002 REPORTED PROJECTS

RUSSIAN FEDERATION											
RF-1	Hail supp Res. Dev. Op.	Target 20,000 km^2 Control area 12000 km^2	Hail protection (suppression) by rocket method	South of Russia: North Caucasus	1960 Every year Yes	Agr (G) Met Serv (G)	rockets, generator with pyrotechnic flare. Release of seeding is cloud base and in-cloud..Temp ≤ 4;5°C .	Agl 40 kg/year.	Convective clouds with base colder than +10°C, top temp colder than –20°C Radar clouds characteristics degree of convective instability of the atmosphere.	April-September 42 days	Comparison historical records. Crop damage Hail pads Doc available in WMO. EIS-Yes C/B-Yes
SERBIA AND MONTENEGRO											
SM-1	Hail Supp Op	Target Area 70 858 km^2	Hail supp system in Serbia	The territory of Republic of Serbia	1967 Every year Yes	Pyro technic rocket Agr (P) Wea. Serv	In cloud seeding from 4°C to 12°C.	Agl 5.62 kg/units 5112.6 kg	Convective clouds coldler than +10°C top temperatures colder than –20°C. Radar reflectivity log>4.5. Max radar reflectivity height above 0°C. Height of increase radar echo above –14°C and radar echo to height above –28°C.	15 April – 15 October 72 days	Comparison historical records. Crop damage Doc available in WMO. EIS-No C/B-Yes
UBEKISTAN											
UZ-1	Hail Supp		Fergen Valley Suhandarja Kashkadarja Samarkand region		1969	Agr		Ag I 20gr/km^3 64,2 kg	Temp at cloud base above +10°C. Top below –20°C	1 April 31 Aug.	Comparison EIS-Yes C/B-Yes

V. ADDRESSES OF REPORTING AGENCIES

ARGENTINA	IDEPRN Facultad d'ingeneria Universidad Nacional de Cuyo CC405 CP 5500 MENDOZA
ARMENIA	Agency for Hydrometeorology and Monitoring of Environment Weather Modification Center 54 Ul- Leo YEREVAN 375002
AUSTRALIA	Hydro Electric Corporation Production group P.O. Box 355 HOBART, Tasmania 7001
AUSTRIA	Central Institute of Meteorology and Geodynamics Department of Climatology Hohe Warte 38 A-1190 VIENNA
BULGARIA	National Institute of Meteorology and Hydrology Bulgarian Academy of Sciences 66, Tsarigradsko Chaussee SOFIA 1784
BURKINA FASO	Cellule Scientifique et Technique Programme SAAGA 01BP 6299 OUAGADOUGOU 01
CANADA	Alberta Severe Weather Management Society 600, 708 – 11th avenue, SW CALGARY, Alberta T2R 0E4
CHILE	Direccion Meteorologica de Chile Departamento de Meteorologia Applicada Casilla 63, Aeropuerto Internacional Arturo Merino Benitez SANTIAGO
COLOMBIA	IDEAM Subdireccion de Meteorologia Carrera 7, No. 32-16 Piso 17 BOGOTA
FRANCE	Association Nationale d'Etude et de Lutte contre les Fléaux Atmosphériques (ANELFA) 52 rue Alfred Duméril 31400 TOULOUSE AEECNG Place Bossuet 32100 CANDOM

	ACMG Aérodrome d'Agen 47520 LE PASSAGE
GERMANY	Radar info Roomstrasse 18 D-76137 KARLSRUHE
GREECE	Hellenic Agricultural Insurance Organization 45 Mesogion Street P.O. Box 14103 11510 ATHENS
HUNGARY	Nefela Egyesules 7620 PECS, Pf13
INDONESIA	Weather Modification Technical Service Unit Agency for the Assessment and Application Technology BPPT Bldg1, 19 floor Jalan M.H. Thamrin 8 JAKARTA 10340
IRAN, ISLAMIC REPUBLIC OF	National Cloud Seeding Research Centre NACSER P.O. Box 89195-611 YAZD
ISRAEL	Israel Meteorological Service Rain Enhancement Division P.O. Box 25 BET DAGAN 50250
JAPAN	Japan Meteorological Agency Meteorological Research Institute Nagamine 1-1 TSUKUBA, Ibaraki 305-0052
KOREA, REPUBLIC OF	METRI/KMA Remote Sensing Research Laboratory 460-18 Shindaebang-dong Dongjak-gu SEOUL 156-720
MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF	Hydrometeorological Service Skupi BB P.O. Box 218 1000 SKOPJE
MALAYSIA	Malaysian Meteorological Service Jalan Sultan Selangor Daruh Ehsan 46667 PETALING JAYA
MOROCCO	National Meteorological Service BP 8106 Casa Oasis CASABLANCA

ROMANIA	National Institute of Meteorology and Hydrology Regional Meteorological Center SOS Bucuresti Ploiesti 97 BUCHAREST
RUSSIAN FEDERATION	Russian Federal Service for Hydrometeorology and Environmental Monitoring 12 Novagankovsky street 12 MOSCOW 123242
SERBIA AND MONTENEGRO	Republic Hydrometeorological Service of Serbia Kneza Viseslava 66 P.O. Box 100 BELGRADE
UZBEKISTAN	Main Administration of Hydrometeorology 72 Makhsumov st. 700052 TASHKENT

VI. MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

Page

VII: MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

LOCATION AND TERRAIN	PURPOSE AND DURATION	AGENT AND ALTITUDE OF SEEDING	REFERENCES TO PUBLISHED RESULTS	CONTACT FOR INFORMATION
BURKINA FASO				
Programme SAAGA	**Rain enhancement** Cumulus clouds 5 years Mai to October	100 precipitation gauges 15 in target area Reflectivity radar Rainfall enhancement		Programme SAAGA Cellule scientifique et techniques 01BP 6299 OUAGADOUGOU 01
FRANCE				
ANELFA Bassin Aquitain – Bassin Rhodanien – Vallée de la Loire 60000km^2	Hail suppression Cumulus clouds 50 years 15 April – 15 October	Agl. Ground generators 675. Fixed area definition. 9 départements du sud ouest de la France 2 départements du centre de la France 4 départements du sud-est de la France Hilly terrain. Target area. 60000km^2 Mesure physique des chutes de grêle à l'aide d'un réseau de 1081 grêlimètres installés sur la zone cible. 1 jour unité expérimentale 15 journées ensemencées en moyenne pour chaque département Seeding period : 8 h/day Diminution de 42% du nombre de grêlons de diameter supérieur à 7 mm.	Dessens J., 1999 : A physical evaluation of hail suppression project with silver iodide ground burners in South western France. J. Applied meteo, 37, 1588-1599 Dessens J. and R. Fraile, 2000. The effect of silver iodide seeding on hail stone size distribution. J. Weather modification, 32, 26-30.	Dr Claude Berthet ANELFA 52 rue Alfred Duméril 31400 TOULOUSE
GERMANY				
Hail prevention project Stuttgart area. 48°N, 9°E.	Hail suppression cumulus clouds Opened since 1980, every year. 25 April to 15 October	2 airborne generators, seeding 1500m. Variable cloud base 10km. 1.9 kgh^{-1} Fixed area definition. Flat project terrain. Target 2500km^2. Control area 7500km^2		Dr Hesmann Glysi Radar info Roonstrasse 18 D-76137 KARLSRUHE
HUNGARY				
Baranya, Tolna, Somogy counties. Nefela Egyesules	Hail suppression 1 May – 30 September 1991	Agl. On ground generator. 104 generators. Target fixed area. Flat terrain 10000 km^2. Radar reflectivity > 45 dbz.		Karoly Bereczki Nefal Egyesules 7620 PECS, Pf13

VII: MEMBER COUNTRIES REPORTING ON COMPLETED PROJECTS

INDONESIA				
Peningkatan Kemanpuar Mengatasi Banir dengan GBG/Bogor-Cianjur, West Java/Weather Modification Technical Service Unit	Orographic clouds Cumulus clouds From October to November	Black carbon, NaCl + additive 4 generators. 10 until 2003. Target area. 850 km^2. Experimental Unit. Planned 5 hours and 30 days per year after 10 generators are already built.		Mr Bajinda Patar Sitorus Weather Modification Technical Service Unit BPPT Bldg, 19 floor Jalan M.H. Thamrin 8 JAKARTA 10340
KOREA, REPUBLIC OF				
Development of weather modification technique in Korea. Korea Meteorological Administration. METRI	Precipitation augmentation rainfall. Stratiform cloud. Year 2000 - To be continued	Flat terrain. Target area. 400 km^2. Radar reflectivity . GMS satellite . Airborne generators about 15,000 feet. AgI. 4g/min. CO_2 12g/sec.		Dr Jae-Cheol Nam Meteorological Research Institute METRI/KMA 460-18 Shindaebang-dong, Dongjak-ku SEOUL 156 720
MACEDONIA, THE FORMER YUGOSLAV REPUBLIC OF				
Hail suppression project Hydrometeorological Service of Macedonia	Hail suppression Cumulus clouds 31 since 1971 April to October	AgI. Seeding operation: -6°C – 12°C Target only. Hilly terrain. Radar reflectivity.		Hydrometeorological Service Skuppi 218 1000 SKOPJE
MOROCCO				
Haut Atlas. Programme Al-Ghait. Hilly terrain.	Precipitation Augmentation rainfall and snow. Orographics clouds 19 years 1 November – 30 April.	AgI. Iodure de sodium + acetone G/B and airborne seeding from 15 G/B generators. 12 precipitation gauges and 2 recording gauge. Other verification accomplished by radar reflectivity. Results tested by statistical, physical and chemical methods. Qualitative tests indicate increased precipitation: seed/no seed ratio 17%.		Dr Grana Laidi Direction de la Météorologie Nationale BP 8106 Casa-Oasis CASABLANCA

SERBIA AND MONTENEGRO				
Hail suppression system of Serbia. Territory of Republic of Serbia. Hydrometeorological Service of Serbia.	Hail suppression. Cumulus cloud. 1967-05-12-2003 15 April – 15 October	Agl. Target only. Fixed area. 12 radar centre. Project on Mountainous, hilly and flat terrain. Target area. 70,858 km^2. Radar reflectivity quantitiies, crop damage. Radar reflectivity > 4,5. Max radar reflelctivity height above 0°C. increased echo height above –74°c. Radar echo top height above –28°C. 0.9 hours standard seeding period		Republic Hydrometeorological Institute. Department of Meteorology and Development of Hail Suppression Sector. Kueza Visestava 66 Box 100 BELGRADE

VIII. MEMBER COUNTRIES REPORTING *NO* WEATHER MODIFICATION PROJECTS IN 2002

Bangladesh
Belgique
Belize
Benin, République du
Botswana
Commonwealth of Dominica
Congo, Republique du
Costa Rica
Cyprus
Czech Republic
Denmark
Dominican Republic
Ecuador
Egypt
Estonia
Finland
Georgia
Guyana
Guinea Bissau
Hong Kong, China
Iceland
Ireland
Kenya
Kazakhstan
Latvia, Republic of
Lithuania
Macao, China
Malawi
Maldives
Nicaragua
Pakistan
Portugal
Saint Lucia, West Indies
Singapore
Slovenia
Sudan
Sultanate of Oman
Sweden
Switzerland
Trinidad and Tobago
Turkey
Turkmenistan
United Kingdom
USA

IV. REGISTER OF 1999, 2000 REPORTED PROJECTS – **LATE ARRIVALS**

ARGENTINA											
AR-1	Hail suppression Res. Op.	Target area 3200 km^2 Control area 4500 km^2	Target area 3200 km^2 Control area 4500 km^2	Mendoza	1999 6 months by year (Oct-March) Yes	Agr (G) Res. Found (G) Univ.	4 aircrafts Pyrotechnic flares Cloud base, cloud top, in cloud between –5°C, -10°C	AgI 40,000 flares x 20 g And 2000 bips by year (mean of 4 year) 1200 kg each year (means between 1999-2003)	Convective clouds warmer than +10°C Cloud top colder than –20°C. Microstructure unseeded cloud measured. All clouds are seeding	Since October until March between 1999-2003 60 by year	Comp Historical records Crop damage Doc planned and available EIS-Yes C/B-Yes
AR-2	Hail suppression Res. Op.	Target area 3200 km^2 Control area 4500 km^2	Target area 3200 km^2 Control area 4500 km^2	Mendoza	1999 6 months by year (Oct-March) Yes	Agr (G) Res. Found (G) Univ.	4 aircrafts Pyrotechnic flares Cloud base, cloud top, in cloud between –5°C, -10°C	AgI 40,000 flares x 20 g And 2000 bips by year (mean of 4 year) 1200 kg each year (means between 1999-2003)	Convective clouds warmer than +10°C Cloud top colder than –20°C. Microstructure unseeded cloud measured. All clouds are seeding	Since October until March between 1999-2003 60 by year	Comp Historical records Crop damage Doc planned and available EIS-Yes C/B-Yes
FRANCE											
FR-1	Op. Res. Hail Supp.	Target area 80x40 km^2	Hail suppression programme using Ag-I rockets	North of Gers (8 canton)	2000 every year Yes	Agr (P) AEECNG	Seeding rockets explosive generator cloud base seeding material.	AgI Depending on the size of the cloud.	Convective clouds; (cumulocongestus and cumulonimbus) colder than +10°C and cloud top colder than –20°C. Microstructure unseeded cloud measured with TITAN but no aerosols.Risks of thunderstorms delivered by Meteo-France radar with TITAN allow to decide which cell has to be treated when the hail risk is confirmed in the zone.	May until September Average 15 days.	Hail pads. Report planned not available EIS-No C/B-YES

FR-2	Op. Res. Hail Supp. Frost	Target area 80x40 km^2 Control area 100x60 km^2:	Test de lutte antigrêle utilisant sels hygros-copiques	Department Tarn et Garonne. Montauban	1995 Every year yes	Agr (P) AEAG	1 aircraft cloud base and pyrotechnic flare generator.	NACl – 2 flares of 1kg every 4mn. 160 kg	Convective clouds. Cumulo congestus and cumulonimbus colder than +10°C Tops colder than –20°C	20th April – 30th September Averages 15 days.	Hail pads. Comparison to non seeded cells with TITAN. Doc available in WMO. EIS-YES C/B-YES
IRAN, ISLAMIC REPUBLIC OF											
IR-1	Prec Enh Water Suplf Auge Op	Target and control area circle. 200 km radius	Yazd	Central of Iran Yazd Fars Province	1999 Yes	Energy	1 aircraft explosive cloud top	AgI 4 kg	Convective Orographic layer clouds Colder than +10°C Top temp Colder than 0°C but warmer than –20°C suitable cloud coverage	Feb-March April 90 days	Comparison historical record Doc planned EIS-No C/B-No
IR-2	Prec Enh Water Suplf Auge Op.	Gilian Province and nearby area	Gilan	Basin of Caspian sea in North Iran Lat: 36°7-38°5 Long 43°0-50°7	June –July 1999	Energy	1 aircraft acetona Burner cloud top seeding, cloud base, in cloud	AgI 10-1000 g/hr	Convective and orographic layer clouds colder than +10°C. Based on satellite images and weather reports	June-July 1 month	Comparison Historical records Document planned EIS-No C/B-No

IV. REGISTER OF 1999, 2000 REPORTED PROJECTS – **LATE ARRIVALS**

KOREA, REPUBLIC OF											
KO	Prec Enh Water Supply Aug Dev	Target area 400 km^2	Development of weather modification techniques in Korea	Kyungnam Province	June 2000 Every year Yes	Wea Ser (G)	2 aircrafts generators with pyrotechnic flare and solid dispersal seeding in cloud temp –4°C	AgI 4g/min 0.6 kg per year 12g/sec 80kg per year	Layer clouds Temperature colder than +10°C and top colder than O°C but warmer than –20°C Weather forecast of KMA	March 2 days	Randomized experiment Documentation planned EIS-Yes C/B-No

WEATHER MODIFICATION PROGRAMME REPORTS

1. Review of Warm Cloud Modification by Bh. V. Ramana Murty (September 1984) (TD No. 5) (*out of print*)

2. Papers presented at the Fourth WMO Scientific Conference on Weather Modification (Honolulu, Hawaii, 12-14 August 1985) (TD No. 53) *(out of print)*

3. Notes for the International Cloud Modelling Workshop/Conference (Irsee, Federal Republic of Germany, 15-19 July 1985) (TD No. 57) (*out of print*)

4. Register of National Weather Modification Projects 1983 (November 1985) (TD No. 78)

5. The Evaluation of Hail Suppression Experiments – Report of Meeting of Experts (March 1986) (TD No. 97)

6. Information concerning Weather Modification directed to Government Decision-Makers (June 1986) (TD No. 123)

7. Trends in Weather Modification 1975-1983 (L.R. Koenig, Geneva, November 1986)

8. Report of the International Cloud Modelling Workshop (Irsee, Germany, 15-19 July 1985) (TD No. 139)

9. Register of National Weather Modification Projects – 1984 and 1985 (Geneva, July 1987) (TD No. 182)

10. Register of National Weather Modification Projects – 1986 (Geneva, December 1988) (TD No. 208)

11. Report of the Second International Cloud Modelling Workshop (Toulouse, 8-12 August 1988) (TD No. 268) (*out of print*)

12. Papers submitted to the Fifth WMO Scientific Conference on Weather Modification and Applied Cloud Physics (Beijing, China, 8.-12 May 1989) (TD No. 269)

13. Register of National Weather Modification Projects – 1987-1988 (TD No. 330)

14. Register of National Weather Modification Projects 1989 (Geneva, May 1991) (TD No. 417)

15. Report of a Meeting of Experts to Review Findings and Make Recommendations on the Saudi Arabia Cloud Physics Experiments (SACPEX), (Geneva, 14-16 November 1990) (*out of print*)

16. Report of the Seventeenth Session of the Executive Council Panel of Experts/CAS Working Group on Physics and Chemistry of Clouds and Weather Modification Research (Geneva, 19 to 23 November 1990)

17. WMO Meeting of Experts on the Role of Clouds in the Chemistry, Transport, Transformation and Deposition of Pollutants (Obninsk, 30 September – 4 October 1991) (TD No. 448)

18. Register of National Weather Modification Projects 1990 (TD No. 449)

19. Proceedings - WMO Workshop on Cloud Microphysics and Applications to Global Change (Toronto, Canada, 10-14 August 1992) (TD No. 537)

20. Report of the Third International Cloud Modelling Workshop (Toronto, Canada, 10 to 14 August 1992 (TD No. 565)

21. Register of National Weather Modification Projects 1991 (TD No. 575)

22. Sixth WMO Scientific Conference on Weather Modification, Volumes 1 and 2 (Paestrum, Italy 30 May – 4 June 1994) (TD No. 596)

23. Register of National Weather Modification Projects 1992 (TD No. 686)

24. Eighteenth Session of the Executive Council Panel of Experts/CAS Working Group on Physics and Chemistry of Clouds and Weather Modification Research (Geneva, Switzerland, 30 January to 3 February 1995) (TD No. 687)

25. Register of National Weather Modification Projects 1993 and 1994 (TD No. 745)

26. Expert Meeting to Review the Present Status of Hail Suppression (Golden Gate, Highlands National Park, South Africa, 6-10 November 1995) (TD No. 764) (*out of print*)

27. Nineteenth Session of the Executive Council Panel of Experts/CAS Working Group on Physics and Chemistry of Clouds and Weather Modification Research (Geneva, Switzerland, 5 to 9 May 1997) (TD No. 820)

28. Register of National Weather Modification Projects 1995 (TD No. 851)

29. Report of the Fourth International Cloud Modelling Workshop (Clermont Ferrand, France 12 to 16 August 1996) (TD No. 901)

30. Proceedings of the WMO Workshop on Measurements of Cloud Properties for Forecasts of Weather and Climate (Mexico City, 23-27 June 1997) (TD No. 852)

31. Seventh WMO Scientific Conference on Weather Modification (Chiang Mai, Thailand, 17 to 22 February 1999) (TD No. 936) (3 volumes)

32. Register of National Weather Modification Projects 1996 (TD No. 939)

33. Report of the WMO Workshop for the Planning of Precipitation Enhancement Projects in the Mediterranean SE Europe and Middle East Countries (MEDSEEME-PEP), Monselice, Italy 8 to 11 December 1999) (TD No. 998)

34. Register of National Weather Modification Projects 1997 and 1998 (TD No. 1001)

35. Report of the WMO International Workshop on Hydroscopic Seeding Experimental Results, Physical Processed and Research Needs (TD No. 1006)

36 Report of the Executive Council Panel of Experts/CAS Working Group on Physics and Chemistry of Clouds and Weather Modification Research (Geneva, 20-24 November 2000) (TD No. 1059)

37. Register of National Weather Modification Projects 1999 (TD No. 1060)

38. Register of National Weather Modification Projects 2000 (TD No. 1094) **(cancelled and inserted in WMO 40)**

39. Eighth WMO Scientific Conference on Weather Modification (Casablanca, Morocco, 7-12 April 2003) (TD No.1146)

40. Register of National Weather Modification Projects 2000-2001 (TD No. 1191)

41. Hail Suppression Research No.5 – Meeting of Experts on Hail Suppression in collaboration with ROSHYDROMET (Nalchik, Russian Federation ,27 September – 2 October 2003) (TD No-

42. Regional Seminar on Cloud Physics and Weather Modification (Damascus, 17 to 20 October 2003) Local organization by the Syrian Meteorological Department