# MEMOIRE DE LA CHAMBRE DE COMMERCE DE VAL D'OR-BOURLAMAQUE SUR LA PRECIPITATION ARTIFICIELLE DE PLUIE ET DE NEIGE.

# M E M O I R E

de la

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ET DE NEIGE.

Val d'Or, le 14 janvier 1959 -

Monsieur R.-Gérard Nadeau,
Président,
La Chambre de Commerce de Val d'Or-Bourlamaque,
C.P. 417,
VAL D'OR, Qué.

Monsieur le président,

Pour faire suite au désir exprimé par les membres de La Chambre de Commerce de Val d'Or-Bourlamaque, nous avons étudié sérieusement le problème de précipitation artificielle de pluie et de neige.

Le présent rapport est le complément de nos recherches, interviews, et contient des reproductions d'articles de divers journaux et revues qui se sont intéressés, au cours des dernières années, à cette question que nous considérons d'une très grande importance à la stabilité et surtout à l'expansion de notre industrie touristique et de notre agriculture.

Nous tenons à attirer votre attention sur le fait que la plupart des articles que nous reproduisons dans ce rapport ont été rédigés en anglais, les journaux de langue française ayant gardé sur le sujet un silence presque complet. Nous avons cru bon, afin de n'en pas changer le sens, de les reproduire au texte.

Nous devons nous rendre à l'évidence, M. le président, que des générateurs augmentent considérablement la précipitation de pluie normale, et ceci au détriment de nos commerces, de nos industries, des colons, des cultivateurs, car, à la suite

des recherches que nous avons effectuées, nous en sommes venus à la conclusion que ces générateurs ne sont soumis à aucun contrôle. Nos hôteliers et nos commerçants sont d'accord pour affirmer que le nombre des touristes diminue. Comment peut-il en être autrement lorsque nous n'avons que très peu de soleil à offrir à ces touristes, durant la "belle saison" et cela plus particulièrement depuis les deux dernières années.

Permettez-nous de vous citer le rapport d'un agronome régional, paru dans le journal "Le Progrès" citons:

"Cette année, les récoltes dans le comté de Rouyn-Noranda ont été très faibles, se comparant avec les pauvres résultats obtenus au cours de l'année désastreuse de 1955", nous a révélé M. L. A. Tremblay, agronome de comté. "La récolte de foin, déclare encore M. Tremblay, a été presque nulle, de nombreuses pluies durant toute la saison ayant nui à la végétation. Pourtant, au printemps, ça s'annonçait bien de ce côté." "Le grain, continue M. Tremblay, ne vaut rien dans une proportion de 90%, les pluies et la gelée ayant fait des ravages considérables. Pour prendre soin des animaux cet hiver, dans notre comté, il faudra faire venir au moins 3,000 minots de grains. Les patates ont pourri sur place, et la récolte des bleuets a été presque un désastre cette année, le nombre des paniers expédiés diminuant considérablement sur les envois de 1957, qui fut pourtant une année assez faible."

Des enquêtes faites depuis près de dix ans dans nos régions nous portent à croire que, dans un avenir rapproché, l'Abitibi

est appelée à devenir le jardin de la province de Québec. Mais il ne faudrait pas que les cultivateurs, en plus de subir les intempéries dont l'instigatrice est la Providence, soient aux prises avec des générateurs de pluie artificielle qui, s'ils étaient employés à bon escient, pourraient devenir des aides précieux pour nos cultivateurs au cours des périodes de sécheresse.

A l'intention de ceux qui sont encore sceptiques sur l'efficacité de ces machines, nous vous citons des articles publiés dans des revues et journaux américains et canadiens sur le sujet. Voici, comme premier article, ce qui a paru dans le "Time" du 6 octobre 1958:

"Rainmaking with Soot?

"Most clouds and fogs are made of water droplets that are too small to fall. Nature has various methods of making the droplets grow big enough to fall as rain, but they are not always in operation. Often great clouds heavy with water float across a thirsty land without dropping rain, or fog hangs for hours over an airport.

"The well-known silver iodide and Dry Ice methods of cloud precipitation work only on clouds that are well below freezing. Warm clouds are common too, and Dr. Florence W. van Straten of the Naval Weather Service reasoned that they should precipitate if some of their droplets could be made warmer than the others.

"The problem was how to heat the droplets differentially. Dr. van Straten solved it with carbon black, which is a fluffy kind of soot whose intensely black particles, about 1/500,000-in. in diameter, accumulate radiant heat just like a black-top road. When these particles are released in a cloud, she reasoned, the water droplets that capture one or more of them should grow warmer by absorbing sunlight, and should lose their moisture by evaporation to droplets that have stayed comparatively cool because they have captured no particles. Then the cool, fattened-up droplets should fall slowly through the cloud, growing gradually bigger by jostling small droplets and combining with them. Eventually they should grow big enough to fall from the cloud.

"This system, worked out theoretically, worked like a charm in actual fact, the Navy announced last week. It was tested last July over the coast of Georgia. The usual tactic was to attach a package of 1½ lbs. of carbon clack to a static line and toss it out of an airplane flying through the top of a cloud. When the slack snapped out of the line, the package broke open, releasing the carbon black. Seven clouds out of seven tested dissipated entirely in 2½ to 20 minutes.

"When carbon black is released in moist, cloudless air, the effect is opposite but no less magical. Its black particles catch sunlight and heat the air between them. The heated air rises, expands and grows colder. Some of its moisture condenses, and a

new, white cloud appears in the sky. This system will not form clouds in dry air, but when the air is moist enough, it works almost every time. The official Navy attitude is that the action of carbon black is "an interesting effect" that will have to be studied a great deal more before it can be rated as a promising rainmaking agent."

Toujours sur le même sujet, nous vous soumettons un article du "Saturday Evening Post" du 29 novembre 1958, par le Capitaine Howard T. Orville, U.S.N. (Ret.), "chief aerologist" de la Marine Américaine durant la dernière guerre:

"Mankind has been worrying about the weather ever since the first farmer discovered how to plant the first hill of corn and, starting with Aristotle, a great many seers, astronomers, witch doctors and scientists have been trying to do something about it. Now, after some 2500 years of fumbling, there is reason to believe that the scientists can succeed -- if given the opportunity -- in a way that may affect the future of civilization even more drastically than the development of atomic power.

"As former chairman of the President's Advisory Comittee on Weather Control, I should begin by making it clear that we are still at an early stage of meteorological research in weather control. Not all scientists agree on what men may be able to do in the future to modify the climate in which we live. We do not yet know enough about our universe for positive predictions. But

we are learning rapidly and I can safely mention a few theoretical possibilities on the road to eventual control of the weather:

"1. Hurricanes, tornadoes and other severe storms may be spotted at birth by earth satellites carrying television equipment, and then dissipated by artificial means or diverted away from populated areas.

"2. In experiments in New Mexico, rockets have been used to spread chemicals that changed the composition of the upper atmosphere. Successful development of the ability to alter the atmosphere could lead to far-reaching climate modifications and theoretically could free the Plains States of droughts.

"Such changes in our climate may seem as fantastic as a page from a science-fiction book. That they are glimpses into the future is obvious, but that future may be much nearer than we realize. I do not want to give anybody an erroneous impression that modern science will soon be able to guarantee a sunny day for your annual church picnic. Nobody -- not even the Old Farmer's Almanac! -- can do that. But I am confident that the next few decades will bring tremendous progress in man's abitily to modify our climate.

"Some of our Government-sponsored weather projects are kept secret because they involve national defense, but others, such as the seeding of clouds to produce rains, are usually in the hands of commercial companies. Modern scientific attempts to increase

rainfall usually are dated from experiments by August W. Veraart in Holland in 1930; but such efforts were often greeted with skepticism and sometimes with ridicule for the next twenty years -- even after Dr. Irving Langmuir and Dr. Vincent J. Schaefer made important discoveries in the field in 1946. Then Dr. Bernard Vonnegut found that microscopic silver-iodide crystals- - really silver-iodide smoke produced by generators -- were more effective in seeding clouds. This resulted in greater interest by our Government, and several projects were established. By the early 1950's, from $3,000,000 to $5,000,000 was paid annually by farmers and water-power companies to commercial cloud-seeding concerns in an effort to increase rainfall, mostly in the Western states.

"There is no question in my mind that the seeding of clouds, which was ridiculed by many scientists only a few years ago, has been proved effective, within limitations, in increasing rainfall. The Advisory Committee on Weather Control analyzed data of twelve commercial cloud-seeding projects involving 427 storms which has been seeded. With the co-operation of Government and educational groups we set up experiments in various states from California to New Hampshire with carefully designed controls to provide evaluation data. In its report the commitee concluded that silver-iodide seeding of wintertime storm clouds in mountainous areas of the Western states produced an average increase in precipitation of 10 to 15 per cent, "with heavy odds that this increase was not the result of natural variations in the amount of

rainfall." In nonmountainous states, increased precipitation was not detected, possibly because our statistical methods were not sensitive enough."

Certains passages de cet article nous portent à refléchir.

Tous les nuages qui nous viennent du nord, vu les immenses étendues d'eau et de glace au nord de nous, sont chargés de glace. Par conséquent, ils sont propices à l'ensemencement par les vapeurs d'iodure d'argent des générateurs. Il est possible d'exercer un certain contrôle sur ces vapeurs, lorsqu'il s'agit du temps et de l'endroit où on doit les faire brûler, mais ces nuages s'en vont ensuite, ainsi ensemenés, aux caprices de tous les vents. Vous êtes-vous déjà arrêté à remarquer les caprices du vent dans notre région, avant 9:00 heures du matin? La plupart du temps, dans une proportion de 75%, vous ne pourrez dire de quelle direction il viendra. Vous avez dû aussi remarquer la rapidité avec laquelle s'effectue un changement de température, au cours de l'été. Souvent, la température se transforme en quelques minutes seulement. Voilà pourquoi la Weather Enginaering peut, à quelques heures d'avis, et dans certains cas, dans quelques minutes, obtenir une précipitation de pluie. Pour ce faire, il lui suffit de faire quelques appels téléphoniques à des personnes qui exploitent pour son compte ces générateurs dans notre région. Nos recherches ont démontré qu'il existe dix-sept de ces machines à Rapide 7, au Barrage Dozois, au Lac Blouin, et même en plein centre de la Ville de Val d'Or. Comme vous pourrez le constater dans la repro-

duction d'un prochain article, l'ensemencement des nuages chargés de glace a pour résultat une pluie soudaine, torrentielle, qui vous tombe dessus avec le même effet que si on venait de vous verser un sceau d'eau sur la tête.

Nous vous citons maintenant un article paru dans la revue "Fortune" de mai 1958, et intitulé: "Forecast for Weather Control: Brighter", par Francis Bello:

"Tired of being buffeted around by the weather, man now hopes to control it. The job is formidable -- some say impossible -- but ingenious rainmakers have already shown they can influence the weather.

"Changing the weather means, primarily, doing something about precipitation. The western half of the country would like more rainfall. The eastern half, which normally has plenty, would like to be able to produce more in the occasional dry periods. On the evidence to date, it has been in the West, especially in its mountainous areas during winter and early spring, that cloud seeding has shown the most promise.

"In both the East and the West storm suppression -- still in the early research stage -- would be most welcome: in the western plains, where cropdamaging hail falls more than four days a year; in five states where lightning annually sets more than 400 forest fires; and in regions where tornadoes and hurricanes strike with regularity. A populous region near the Great Lakes

might also favor a limitation on snowfall. The map shows an area where snow annually exceeds sixty inches; while some of this snow delights skiers, the snow that falls on cities is a costly nuisance. One other possible objective: to hold the winter freezing line (actually, the line where the average daily minimun temperature reaches freezing) from dipping into the sunny South. This past winter it dipped disastrously.

"For ten years professional meteorologists heaped scorn on anyone who thought he could tamper with the weather. But some people have done it, brilliantly, and, ironically it is chiefly because of these outsiders that meteorology seems finally ready to take its place with the modern experimental sciences. As more effort is put into weather research the U.S. can reasonably expect a sharp improvement in short and long-range forecasting. Beyond that lies the exciting prospect of weather modification on a really large and significant scale -- the ability to hold within tolerable bounds hail, lightning, snowstorms, tornadoes, and even hurricanes. Scientists even conceive the paradox that they may fail to improve forecasts beyond a certain point, but that the very failure may guide them to the crucial levers that control the weather, and even the climate itself.

"Meteorology's transformation into a modern experimental science should have occurred more than ten years ago when cloud seeding was first proposed by General Electric researchers. Instead, U.S. meteorology drifted though more than six years of acrimonious debate, during which time the majority of Weather Bureau and univer-

sity meteorologists seemed more interested in arguing that cloud seeding could not work than in giving it a reasonable test. In this period, commercial rainmakers built up a big business, and while they found it almost impossible to prove results, many of their large customers have kept coming back for more.

"In 1955 the University of Chicago presented the first successful results from a rainmaking project scrupulously surrounded by scientific "controls." The seeding agent was neither dry ice nor silveriodide, the highly publicized materials, but ordinary water dumped into cumulus clouds from an airplane. To this day the rain and snowmaking value of dry ice and silver iodide experiments are finally under way, and the preliminary results are promising.

"Even meterologists who believe firmly in cloud seeding freely admit that it is only a first step toward weather modification. But it may be a longer first step than is immediately obvious. The great promise of seeding is that it intervenes directly in the precipitation mechanism, and precipitation -- or the dearth of it -- is the aspect of weather that usually causes man the most grief. Broadly speaking, if the U.S. could have rain (or snow) approximately when and where it desired and could suppress the disastrous effects of the most severe storms -- snow, hail, lightning, tornadoes, and hurricanes-- it would probably have achieved enough weather control to satisfy most people. In addition to the mounting evidence that seeding can increase rainfall, there is

preliminary evidence that it may also suppress hail and lightning. And finally there is a possibility -- still to be seriously tested -- that seeding at the right time might blunt, if not dispel, tornadoes and hurricanes.

"In 1946-47, when some of these hypotheses were initially proposed, meteorologists were either amused or outraged. They could calculate that a typical snowstorm releases as much heat (given off when water vapor freezes and turns to snow) as hundreds of atomic bombs, and that a hurricane expends energy at a rate several thousand times that of all the power stations in the U.S. Could such awesome events be influenced by a few pounds of silver iodide or dry ice? Meteorologists laughed.

"They laughed still more derisively in 1951 when the late Irving Langmuir, the distinguished G.E. physical chemist and Nobel Laureate, suggested that for a period of ten months he had influenced the weather over the entire eastern half of the U.S. by operating a single silver iodide generator one to three days a week in Socorro, New Mexico. At the height of the experiment in late 1949 and early 1950 it rained nearly every Tuesday along a line running from Minnesota to Alabama, and one or two days later along the eastern seaboard. After calculating that the odds against such a sharp and prolonged seven-day cycle in rainfall were millions and millions to one, Langmuir remarked that "it may prove easier to make the weather than to predict it."

"Compared to such grandiose schemes, the 1946-47 cloud-

seeding proposals of three General Electric researchers, Vincent Schaefer, Bernard Vonnegut, and Irving Langmuir, seem modest indeed. Nevertheless, they should have electrified all meteorology, for they promised to illuminate an outstanding puzzle.

"Clouds are typically composed of water droplets so small that they may remain suspended in the atmosphere for long periods without producing rain or snow. At the time of the G.E. experiments, meteorologists had only one good theory, the Findeisen-Bergeron theory, to explain how the droplets could be transformed into masses large enough to fall. It was based on the observation that cloud droplets do not freeze spontaneously, as one would expect, when they reach the freezing point, 32° Fahrenheit or 0° Centigrade. Instead, the droplets may remain subcooled but unfrozen for long periods; but if their temperature is reduced to about -- 40° C., freezing will finally take place.

"The theory suggested that if certain kinds of dustlike particles called "freezing nuclei" are present in the cloud, freezing can occur at somewhat higher temperatures, commonly around -15° C. Once tiny ice crystals have appeared in a supercooled cloud they begin to grow by capturing water vapor at the expense of neighboring water droplets, in much the same way that frost builds up in a refrigerator. When the ice crystals have grown sufficiently, they fall as snow, or if they fall through warm air the snow may turn to rain.

"It was while searching for artificial freezing nuclei that Vincent Schaefer discovered accidentally that dry ice, when

dropped into an artificial cloud in a deep-freeze unit, would generate myriads of tiny ice crystals; as the dry-ice pellet falls it reduces the cloud temperature to -40° C., or below. Subsequently, Vonnegut had the bright idea that good "freezing nuclei" ought to be substances with the same crystalline shape as ice itself. He reasoned that if water vapor will freeze on contact with ice, it should also freeze on anything that simulated ice.

"Vonnegut's quick search of a chemistry handbook showed that silver iodide crystals had almost exactly the right sub-microscopic structure. And they worked. Indeed, silver iodide particles "fool" the water vapor so effectively that they will cause ice crystals to form in clouds that are as warm as -5° C. Since this is some ten degrees above the temperature where most natural freezing nuclei are effective, silver iodide, like dry ice, has the potentiality of triggering precipitation when nature cannot.

"These two seeding agents cannot work, of course, if the entire cloud is above freezing, which is usually the case in the tropics, and often the case in the U.S. during the summer. There was, moreover, no good theory in 1946-47 to explain how rain could be produced from warm clouds. After reflecting on this puzzle, Irving Langmuir suggested that sprinkling just a few gallons of water into a deep warm cloud might sweep up millions of small droplets and initiate a sort of chain reaction, as explained below.

"No sooner had G.E. announced the startling news about cloud seeding than the sky was full of amateur rainmakers. (G.E. ,

incidentally, won patents on dry-ice and silver iodide cloud seeding, but has never asked for royalties.) The amateurs were soon followed by a number of private meteorologists who were willing to brave the ridicule of their academic and government-employed colleagues.

"The discovery of cloud seeding could not have come at a more suitable time, for a drought struck much of the U.S. following World War II and deepened steadily for over a decade. By 1951, 10 per cent of the total land area of the U.S. was under contract to rainmakers; a year later, at the peak of the business, the figure was close to 15 per cent. Nearly a third of the cloud seeding was paid for by farmers in the plains states.

"In the Far West, meanwhile, Pacific Gas & Electric, Southern California Edison, and other big utilities began hiring cloud seeders to see if silver iodide would increase rainfall and the winter snow pack behing the utilities network of hydroelectric dams. Much of this seeding was conducted by North American Weather Consultants, of Santa Barbara, which has built up a reputation among academic meteorologists as the soundest firm in the business. Another early seeder was Water Resources Development Corp. of Denver, run by the ebullient Irving Krick.

"Krick's claims, which embrace not only rainmaking but long-range forecasting, have not endeared him to his academic colleagues. Recently Krick has tied rainmaking and forecasting

into a single package. He tells a prospective customer how much rain will fall naturally (based on a forecast made by a Univac), and guarantees to increase this at least 10 per cent by seeding. If the customer is satisfied from the forecast that nature will provide enough rain without help from Krick, he may pass up the seeding. If he contracts for seeding he pays only for the rain in excess of that forecast.

"Two of North American's customers, Pacific Gas & Electric and Souther California Edison, are now finishing their sixth and eighth seasons of seeding, respectively. Neither will say that seeding has achieved significant increased in snow pack upstream from their hydro plants, for fear the public-utilities commission will suggest a decrease in their poser rates. But the fact that both firms have continued to seed each season, at a cost ranging from $25,000 for S.C.E.'s single project up to an estimated $100,000 for P.G. & E.'s three projects, is evidence that the results are not discouraging. At a conservative estimate, a 10 per cent in increase in snow pack would be worth at least $1 million to P.G. & E.

"In 1953, when commercial seeding was close to its peak, farm-belt Congressmen sponsored the setting up of the Advisory Committee on Weather Control to make a complete study of the controversial subject. The committee contained representatives from six government agencies, plus five nongovernment members appointed by the President. (Howard T. Orville, captain, U.S.N. (ret.), chairman (vice president of Beckman & Whitley, Inc., San Carlos California),

A.M. Eberle (Dean of Agriculture, South Dakota State College), Lewis W. Douglas (former Ambassador to Great Britain), Brigadier General Joseph J. George (head of meteorology, Eastern Air Lines), and Kenneth C. Spengler (executive secretary, American Meteorological Society).

"When the committee began its work there was still not a single positive result from rainmaking that would stand up to rigorous statistical scrutiny. Since the committee was not authorized to conduct new experiments of its own, it had to mine available data, which were those obtained in an independent-minded Weather Bureau statistician named Herbert C.S. Thom.

"As Thom knew, rainfall varies so markedly from year to year that a simple comparison of the rainfall in seeded years with the historical record is valueless. Thom therefore chose to compare rainfall in a designated target area with that in a control area nearby. Even so, he was confronted with sizable discrepancies between rainfall in the two areas, due simply to natural fluctuations. He was able, nevertheless, to devise a number of mathematical stratagems to extract a maximum of information from the data.

"All the basic data on precipitation came from official sources; the commercial operators provided the target locations and a list of the storms they had seeded. Thom divided the projets into three classes, mountainous, semi-mountainous, and flatland,

and reached the following conclusions:

"-- Commercial seeding in five mountainous regions (including one in the French Alps) showed an increase in precipitation of about 14 per cent.

"-- Seven mountainous and semi-mountainous seeding projets, all on the U.S. West Coast, also showed an increase of about 14 per cent. (These included the Southern California Edison and P.G.E. projects.)

"-- Four flatland projects (in South Carolina, upper New York State, Dallas, and Kentucky) showed no significant increase.

"When Thom first reported his results two years ago at an international meeting he was viciously criticized by K. Alexander Brownlee, a University of Chicago statistician. Brownlee said he was "frankly appalled that such a travesty of statistics should be presented to (the conference)." Brownlee's attack confirmed the prejudices of many meteorologists and cast a cloud over Thom's findings that has not been entirely dispelled even though Thom's work had been examined before and has been subsequently endorsed by a committee of outstanding statisticians.

"Brownlee did, however, have a point. Seeded and unseeded storms were not intermixed in random fashion, hence one might argue that the rainmakers somehow were able to select for seeding precisely those storms that would have favored the target area anyway.

"No one has ever seriously claimed that the cloud seeders possess such a remarkable skill, but to answer all objections, a scrupulously designed seeding experiment was begun is January, 1957, in the mountains surroundings Santa Barbara, California. The Santa Barbara Project was set up at the urging of the advisory Committee on Weather Control and has an unimpeachable list of sponsors. The experiment itself was designed by one of the country's top statisticians (and a critic of many previous rainmaking efforts), Jerzy Neyman, of the Statistical Laboratory of the University of California at Berkeley.

"The experiment works in this manner. Twice a day during winter and early spring. North American Weather Consultants analyzes the weather charts and decides whether or not a seedable storm will develop in the Santa Barbara area in the ensuing twelve hours. If the outlook is favorable, North American notifies Neyman's group at Berkeley and asks for a decision to seed or not to seed. This decision, arrived at on a random basis, is teletyped to North American. If the decision is "yes", the cloud seeders fire up their silver iodide generators. All storms are tracked by radar and precipitation is measured by a dense network of thirty-seven recording rain gauges.

"In the first seasor it appears that seeding increased precipitation a little more than 20 per cent. The experiment will have to run at least three years before its effectiveness can be evaluated properly. "After all," says Bob Elliott, North American's president, "one season could be just a fluke. But it's

too bad the experiment wasn't started ten years ago."

"Elliott has been strenuously urging a rerun of the disputed Langmuir experiment. He believes that silver iodide put into the atmosphere by commercial rainmakers should not interfere with the experiment if the periodic seeding is done from a point off the coast of California. If the off-coast generators set up any periodicity in U.S. rainstorms, the commercial seeders will recognize these storms as seedable situations, start up their generators, and presumably amplify any periodic effect that may be produced.

"A second well-designed seeding experiment that is attracting much professional attention was begun last summer near Tucson by the Institute of Atmospheric Physics of the University of Arizona in cooperation with the University of Chicago. The institute discovered that it rarely rains in summer in Tucson unless the atmosphere contains at least 1.1 inches of "precipitation" water -- that is, enough water vapor to produce 1.1 inches of rain if all of it could be made to fall. The typical symmer range is from about 0.6 to 1.5 inches. (Tucson's average annual rainfall: 10.6 inches.)

"In conducting last summer's experiments the researches designated as seedable all days when precipitable water reached or exceeded 1.1 inches. But the actual decision to seed or not to seed was made on a random basis. If the decision was to seed, a light airplane dispensed silver iodide throughout a four-hour

period from a point some fifteen miles upwind from great cloud banks that formed regularly over the Santa Catalina range north of Tucson.

"The first season's results were encouraging. Rainfall on seeded days averaged about 15 per cent greater than on unseeded ones. But more important, perhaps, eight of the nine days when the maximum rainfall in any one place exceeded one inch were seeded days. This finding, coupled with clues from radar and photo records made of the clouds, has let the Arizona and Chicago researchers to a new and exciting hypothesis. Heavy seeding with silver iodide seems to postpone the onset of rain, thus permitting at least some of the clouds to keep growing and ingesting more water. Result: more rain when it does rain.

"The commercial seeding projects analyzed by Thom, together with the preliminary results of the Santa Barbara and Arizona experiments, have finally forced even conservative meteorologists to change their views about weather modification."

Vous nous excuserez, monsieur le président, de vous présenter un rapport aussi long, mais nous avons cru préférable et même nécessaire de reproduire ces articles au texte, afin de dissiper les doutes qui pourraient encore subsister dans l'esprit de plusieurs, quant à l'efficacité des machines de précipitation de pluie et de neige.

Nous quittons maintenant les Etats-Unis pour revenir dans la province de Québec. D'après des rapports que nous avons obtenus,

la "Laurentian Winter Resort Association" s'est servi de générateurs l'an dernier pour accélérer la précipitation de neige sur ses pistes de ski des Laurentides. Ceci nous porte à croire que certaines tempêtes de neige qui ont déferlé sur la Ville de Montréal, au cours de ce même hiver, provenaient de nuages ensemencés d'iodure d'argent, et qui finissaient de s'y déverser en arrivant à la barrière d'humidité naturelle qu'est le St-Laurent. Car il est tout aussi facile de provoquer une chute de neige en hiver qu'une précipitation de pluie en été. Voici, à l'appui de cet énoncé, une reproduction d'un court article paru dans la revue "Fortune" de mai 1958, et que nous avons d'ailleurs déjà cité dans ce rapport:

"How to Make a Snowstorm:"

"The most widely used cloud-seeding agent is silver iodide,... released from a ground-based generator. The "smoke" is penetrating a supercooled cloud overhanging a mountaintop -- a situation highly favorable to snowmaking. The entire cloud is below freezing, but if nothing is done to it ice crystals will form only in region which contains natural "freezing nuclei," dustlike particles upon which ice crystals will grow. The virtue of silver iodide is that it causes ice crystals to form in warmer regions. ... drawings show how water evaporates from cloud droplets and crystallizes around a silver-iodide particle, forming snow. If the air below the cloud is warm, the snow will, of course, turn to rain."

Dans notre région, nous savons qu'au moins deux compagnies, soit la "Shawinigan Water and Power Co." et la "Weather Engineering Corporation of Canada", qui, en réalité, semble être une filiale de Water Resources Development of Denver, Colorado, se font, selon

toute apparence, une concurrence dans le domaine de précipitation de pluie artificielle. Pourquoi cette pluie? Pour parer aux dangers de feux dans les forêts, pour fournir l'eau nécessaire aux barrages, et pour aider aussi au flottage du bois. Vous serez en mesure de constater, dans la reproduction d'un prochain article, que ces compagnies provoquent des chutes de pluie pour les besoins de leurs opérations, sans, semble-t-il, se soucier du bien-être de la population de notre région.

Reportons nous maintenant à l'hebdomadaire "The Star", publié à Val d'Or. Dans son numéro du 18 septembre 1957, l'éditeur du journal, Alex Dimeo, sous la rubrique "Just Rambling", nous fait part d'une enquête qu'il a menée avec deux employés compétents de la Ville de Val d'Or, MM. Albert Philbert et Guy Saucier. Au cours de cette enquête, ces personnes se sont rendu compte qu'un générateur de pluie artificielle fonctionnait régulièrement sur l'Avenue Chapais, dans les limites de la ville.

A la troisième page du même numéro de "The Star" on peut lire:

"Sitting unobstrusively in front yard of the St. Jacques' frame house is a small metal apparatus some three feet high and a couple of feet wide.

"A flick of the switch on a cloudy day is guaranteed to bring rain within 15 minutes.

"Actually, Mrs. St. Jacques doesn't operate the machine

without specific instructions from the Weather Engineering Corporation of Montreal.

"This Company has contracts with paper and power companies throught the province, agreeing to keep up a reasonable supply of water to keep down the forest fire danger or maintain the flow of water through turbines.

"She told The Star that a long distance call from Montreal may come in at any time, telling her to turn the machine on anywhere from eight to 12 hours.

"It's never failed yet and rain always begins falling within 15 minutes, "she said.

"Mrs. St. Jacques, who has quietly operated the machine for three years now known to only a few friends and neighbors, said on a average her services are called for some two or three times a month.

"Mrs. St. Jacques explained that before the machine is turned on conditions in the area must be exactly right if rainfall is to be brought on.

"To know just the time, Weather Engineering in Montreal receives forecasts and temperature readings daily from across Eastern Canada.

"When conditions are right Mrs. St. Jacques or one of the 17 other machine operators in Northwestern Quebec gets that long

distance call which means rain for the area.

"Mrs. St.Jacques said no effort has been made during the last three years to keep the machine and its operation secret. However, only her friends and close neighbors apparently knew what was going on.

"She says none of the adults have attempted to have her not follow through instructions from Montreal and spare the district from rain, but the children set up a howl when they see her preparing to stoke the apparatus up.

"One of Mrs. St. Jacques' most recent achievements was the prolonged wet spell which ended two weeks ago. Some of her admirers say, in this case, the rain stopped a short while after the machine was turned off."

Avec la collaboration de M. Jean-Paul Rouleau, secrétaire de l'U.C.C. de Fatima, à Val d'Or, et de la Station météorologique 21 du Ministère des Terres & Forêts de Val d'Or, nous avons réussi à compiler, pour l'année 1957, un rapport détaillé des opérations de ces générateurs de pluie artificielle. Voici, ci-après, le rapport en question, sur les opérations d'un générateur, par la Weather Engineering Corporation of Canada, Limited, dans les limites de la Ville de Val d'Or:

| Dates | Jours | Durée des opérations | Quantité de pluie | Durée de la pluie |
|---|---|---|---|---|
| 9 mai | Jeudi | 6 heures | .02 | 1 heure |
| 27 " | Lundi | 4 " | .00 | |
| 1 juin | Samedi | 4 " | .17 | 3 " |
| 19 " | Mercredi | 6 " | .28 | 2 " |
| 23 " | Dimanche | 4 " | .39 | 2 " |
| 29 " | Samedi | 8 " | 1.08 | 5 " |

| Dates | Jours | Durée des opérations | Quantité de pluie | Durée de la pluie |
|---|---|---|---|---|
| 5 juil. | Vendredi | 8 heures | .36 | 9 heures |
| 11 " | Jeudi | 6 " | .05 | 1 " |
| 3 août | Samedi | 8 " | .46 | 4 " |
| 5 " | Lundi | 6 " | .00 | |
| 4 sept. | Mercredi | 8 " | .94 | 12 " |
| 23 " | Lundi | 6 " | .25 | 3½ " |
| 26 " | Jeudi | 4 " | .15 | 4 " |
| 1 oct. | mardi | 6 " | | |
| 9 " | mercredi | 4 " | | |
| 17 " | jeudi | 6 " | .96 | 3½ " |

N.B. Un (1) pouce d'eau équivaut à 100 tonnes d'eau à l'acre.

Voici maintenant un rapport du même genre et qui a trait à l'opération d'un générateur par la Shawinigan Water & Power Co., sur les bords du Lac Blouin, près de Val d'Or, aussi pour l'année 1957:

| Dates | Durée des opérations |
|---|---|
| ler juin | 11 heures |
| 2 " | 9 " |
| 4 " | 12 " |
| 7 " | 9 " |
| 11 " | 7 " |
| 12 " | 10 " |
| 14 " | 14 " |
| 19 " | 3½ " |
| 6 juillet | 8 " |
| 7 " | 8 " |
| 28 " | 7 " |
| 3 août | 9 " |
| 8 " | 6½ " |
| 9 " | 6 " |
| 23 " | 6 " |
| 24 " | 6 " |
| 19 sept. | 9½ " |
| 21 " | 14 " |
| 22 " | 11 " |
| 23 " | 22½ " |
| 24 " | 17 " |
| 25 " | 8 " |
| ler oct. | 8 " |
| 9 " | 8½ " |

Ce rapport, même s'il n'est pas complet quant à la quantité et à la durée de la précipitation, nous révèle tout de même que ce générateur a fonctionné durant 230½ heures. En se basant sur les données de la Weather Engineering Corporation of Canada, Ltd, ces 230½ heures, durant lesquelles cette machine a fontionné, équivalent à une précipitation de 11 pouces de pluie.

Nous reproduisons maintenant une partie d'un article paru dans "Le Bulletin des Agriculteurs" de décembre 1958. Cet article établit une comparaison entre l'année 1958 et les vingt-sept (27) années précédentes:

"Rares sont les cultures dont le rendement n'a pas été affecté par ces pluies trop abondantes et trop fréquentes qui ont marqué la saison de végétation 1958. Le manque de chaleur y a aussi contribué. Des difficultés de toutes sortes sont nées de ces conditions défavorables de température. Les récoltes qui font exception à la règle et qui marquent un gain sur l'an passé sont peut-être: pâturages, pommes, choux, laitue et légumes racines comme les navets, carottes et betteraves.

Précipitation mensuelle 1958 (en pouces d'eau)

| | Mai | Juin | Juillet | Août | Sept. | Oct. |
|---|---|---|---|---|---|---|
| 1958 | 2.16 | 3.70 | 4.66 | 4.57 | 5.23 | 4.05 |
| Moyenne de 27 ans | 3.10 | 3.33 | 3.53 | 3.42 | 3.58 | 2.82 |

Monsieur le président, il faut bien se rendre à l'évidence: des savants ont découvert un moyen artificiel de faire de la pluie. Cette découverte, qui peut rendre de grands services à l'humanité au cours de périodes dites de sécheresse, semble être aujourd'hui exploitée et mise en pratique par deux importantes corporations qui ne semblent avoir qu'un seul souci, celui de faire tomber de la pluie pour le bénéfice de quelques clients tels que les entreprises d'exploitation forestière, et autres du même genre. Vu qu'il n'y a aucun contrôle dans l'exploitation de ces machines, ceci se fait au détriment de l'industrie touristique de nos régions, de même qu'au détriment de nos marchands, contracteurs, ingénieurs, compagnies d'aviation, prospecteurs, mineurs, ouvriers, compagnies de transport et de nos cultivateurs. Ceci est aussi détrimentaire à la santé de la population de nos régions en la privant des bienfaits précieux du soleil, alors que nous vivons dans un coin du pays où les étés sont déjà relativement courts.

Nous croyons sincèrement qu'il est du devoir de La Chambre de Commerce de Val d'Or-Bourlamaque, à la demande de laquelle nous avons effectué ces recherches, d'attirer l'attention des populations des grands centres, par l'entremise des Chambres de Commerce et des corps municipaux sur cette situation anormale, afin de permettre à ces mêmes corps publics de pousser plus loin les recherches et ensuite de revendiquer une réglementation gouvernementale de ces générateurs de pluie artificielle.

Respectueusement soumis,

Le Comité de l'Industrie Touristique
de La Chambre de Commerce de
Val d'Or-Bourlamaque.

Ce mémoire a été présenté aux membres de La Chambre de Commerce de Val d'Or-Bourlamaque, réunis le 14 janvier 1959, en assemblée régulière. Les recommandations faites dans ce mémoire ont été ratifiées par l'assemblée le même jour.

La Chambre de Commerce de Val d'Or-Bourlamaque.