04008943 1000

40-8943

ANDREW B. REID, Attorney at Law
HC 75, Box 33B
Chadron, Nebraska 69337

DOCKETED USNRC SEP 15 1989

September 11, 1989

Mr. Gary Konwinski
Uranium Recovery Field Office
US Nuclear Regulatory Commission
P.O. Box 25325
Denver, Colorado 80225

RETURN ORIGINAL TO PDR, HQ.

SEP 14 1989

re: Crow Butte Project

Dear Mr. Konwinski:

Earlier, I had written the NRC about the concerns of Western Nebraska Resources Council over the existence of significant fractures and faults in the Crow Butte area which could lead to leakage and aquifer contamination during any commercial in situ uranium mining project by Ferret Exploration Company of Nebraska and its joint venture partners. I am enclosing a copy of a recent opinion by Steve Smith, a geologist with the Nebraska Department of Environmental Control, which supports our concerns. His opinion is based upon a review of some of the FEN data pursuant to our previous requests that the NDEC take a closer look at the data. I am also enclosing the FEN response.

Secondly, I am enclosing a letter to the EPA from WNRC on this question and on the issue of ownership and participation in the project by foreign corporations. Attached to the letter are several documents from IMC which outline its role in the project and again substantiate WNRC's comments made previously in this regard.

Please note also that there is another major project adjoining the Crow Butte Project, the Big Red Project, which encompasses 20,000 acres. See 1989 Annual Report, page 9. The Annual Report states that the interests of the Imperial Metal Group now exceeds 100,000,000 lbs of U_3O_8 within a 210,000 acres of the Nebraska panhandle. Clearly, these staggering figures support WNRC's call for a full and timely EIS on the project, and that the EIS be both programmatic and synergistic or regional in scope. WNRC again calls upon the NRC to begin the EIS process immediately.

Finally, would you please see that this letter is passed along to the appropriate persons within the NRC having the responsibility for decisions on the commercial source materials license and on the WNRC request for a full EIS.

DESIGNATED ORIGINAL
Certified By Mary C. Hood

Sincerely yours,

Andrew B. Reid

Andrew B. Reid

cc: US EPA
WNRC

8910050024 890911
PDR ADOCK 04008943
C PNU

Addl Info
89-1005

ANDREW B. REID, Attorney at Law
HC 75, Box 33B
Chadron, Nebraska 69337

September 11, 1989

Mr. Harold Owen, Chief
Ms. Angela C. Ludwig
Underground Injection Control Section
Retion VII, United States EPA
726 Minnesota Avenue
Kansas City, KS 66101

re: Crow Butte Project

Dear Mr. Owen and Ms. Ludwig:

I appreciate your letter of August 24, 1989. I am again writing on behalf of Western Nebraska Resources Council to again bring your attention to two recent, and highly significant, sets of documents regarding the issues before you and the other federal and state agencies reviewing the Crow Butte project.

First, on the question of aquifer integrity, I am enclosing a copy of a memorandum prepared by a Nebraska Department of Environmental Control geologist, Steve Smith. Please note that Mr. Smith, upon reviewing "some information" on a cross section under the existing pilot plant facility, discovered indications of faulting. He further reinterprets the pump test data which he finds may be "directly indicative of faulting in the area." He considers alternative explanations, but finds them not to be pursuasive. I am also enclosing the FEN response to the Smith memorandum.

Mr. Smith's examination of "some" of the cross section data was in response to the questions raised by WNRC over faulting in the area. His findings confirm not only the validity of WNRC's concerns over this issue and the opinions of geologists Warner, Elliot, Adamek, and Petersen (and the two experts from the University of Nebraska at Omaha), but also validate WNRC's position that the FEN interpretations of their own data should be viewed with great suspecion and care. It also exemplifies the dire need of an independent examination of all the FEN raw data.

WNRC recognizes that Mr. Smith states that the "existence of faults is not an a priori reason to deny the operating permit" because the clay in the upper Chadron "could effectively reseal the faults to provide confinement." However, Mr. Smith is viewing the problem as a scientist, not according to the requirements of the Safe Drinking Water Act. FEN does not get the benefit of the doubt. FEN must demonstrate that the clay would, not "could", reseal a leaking fault. The initial burden is on FEN, not the public where potential endangerment to an usdw has been demonstrated by the likely existence of significant faulting. As Mr. Smith does note, this is certainly true where the leakage has appeared in the pump test data.

I would suggest that it should be of very great concern to both the US EPA and the NDEC, as well as the US NRC, that this contrary agency interpretation of FEN raw data came about only as a result of the repeated, strident requests of WNRC and others that the agencies take a hard look at all the raw data rather than rely largely upon FEN on this crucial question. Of equally great concern is the fact that the agency review turned up the questions concerning FEN's interpretation after reviewing only "some" of the available raw data. This suggests that a full review of all of the raw data by independent experts may well uncover other serious questions concerning the FEN interpretations which have been largely relied upon by all of the federal and state agencies involved.

As the burden under the SDWA resides clearly and firmly upon FEN to demonstrate that their exists no potential of endangerment to any usdw by its project, and, further, recognizing FEN's declared great "world class" profits from the project, it would seem a relatively small but crucially important requirement that FEN be required to reimburse the governmental agencies for the expense of retaining independent structural geologists to examine all of the raw data and to conduct angle drilling and additional pump tests to detect the existence of significant faulting and leakage in the proposed commercial mining area. Geologist Roy Elliot recommended these measures in 1985 and has been joined in his recommendation by industry geologist Petersen.

The second set of enclosed documents, the 1989 Annual Report of Imperial Metal Corporation, a Canadian corporation, together with related documents and my September 11, 1989, letter to the Nebraska Attorney General's office, further proves the participation and ownership of the Crow Butte Project by foreign corporations. Please note that the Report discloses that the Imperial Metals Group (IMC, Geomex Minerals, Inc. (a wholly-owned IMC subsidiary) and Ferret) owns 65% of the Project and that IMC itself owns 18.7%, with the remainder held by Uranerz (a wholly-owned West German subsidiary) and "Kepco" (Korea Electric Power Company - South Korean). Report, p. 12 and March, 1989 paper. Note also that IMC recognizes the Nebraska Foreign Ownership laws and the Nebraska low level radioactive waste disposal agreement as impediments to production. Report, p. 9.

Perhaps the most significant disclosure in the Report is the discussion of the "Big Red" Project located to the south of the Crow Butte Project. "Big Red" contains some 20,000 acres and is estimated by IMC to host in excess of 19,000,000 lbs of uranium. It 86% owned by the Imperial Metals Group and 21.04% owned by IMC alone. Report, pp. 9, 12. Furthermore, the Report states: "The Imperial Metals Corporation Group's land position in the Crow Butte region <u>exceeds 210,000 acres</u>. The total resource potential is estimated to <u>exceed 100,000,000 lbs</u> of U_3O_8." Obviously, the plans of IMC and its alien venture partners are far greater than that previously disclosed by them. Equally obvious is the fact that the likely environmental impacts by development on this scale are far

greater than those considered by the US NRC or the US EPA.

It is imperative that the US EPA and the US NRC conduct a full programmatic, synergistic, regional EIS to examine the total, combined impact of the Crow Butte Project, the Big Red Project, and any other uranium development in the area. WNRC formally requests that the preparation of the EIS begin immediately since any further exemption of the Chadron formation SDWA protection may well result in the irreparable commitment of the area to the severe adverse environmental impacts of the uranium industry, a new and historically hazardous industry.

Finally, I would note that FEN and its legal counsel have responded to WNRC's concerns and comments largely by questioning the integrity of WNRC and the experts who question FEN's methods and conclusions. It has consistently avoided full, candid disclosures of contrary internal opinions, of raw data, of alien ownership and interests, and of the holdings and long term plans. It has attempted to brand the comments of WNRC and the structural geologists as frivolous and, having no access to the raw data, as not in a position to know. Yet, the enclosed documents would appear to further vindicate WNRC and these geologic experts. As more and more information is gathered and a hard, questioning examination is made of the raw data by the agencies, the validity of WNRC's concerns and comments have grown consistently stronger and more alarming.

As I read the Safe Drinking Water Act, it was designed to protect people, not promote industry, and especially not to promote the mining of underground sources of drinking water. The issue is not whether the Crow Butte Project is "technologically feasible" or would make a nice experiment of the in situ method of uranium mining. Rather, the issue is whether the agencies will affirm the Act's clear declaration that underground sources of drinking water are deemed to have a categorically greater value to the general public than the minerals located within the usdw formation. The issue is not whether the project seems feasible on paper, but whether there is <u>any potential</u> of endangerment to the usdw. The burden is on the developer of the aquifer, not upon the public, although WNRC has thus far been forced to bear much of the burden of demonstrating potential endangerment. It is time for the EPA, NRC and NDEC to fully shoulder their respective responsibilities, place the burden where it belongs by requiring proof of no faulting which could provide leakage in a worst case, make independent and competent examinations of all the raw data, require angle drilling and further and longer pump testing, and require a full, programmatic and regional EIS. 210,000 acres plus 100,000,000 lbs of U_3O_8 plus foreign corporations plus secrecy add up to economic colonialism pure and simple, in my opinion, with devastation permanently not only to the water resources of the northern Nebraska panhandle, but also to the economy of the area, its communities, and its people. The issue is people, not profits.

Recently, the town of Crawford, as I am sure you are aware, suffered the loss of the main source of drinking water for the town, the White River, due to silting from summer fires and low flow. This event was not only frightening to the residents of Crawford, but dramatically demonstrates the community's dependence upon a reliable and sufficient source of water. As we noted previously in our earlier submissions, the analysis made by the FEN contractor of the use of the Chadron aquifer as a source of drinking water for Crawford was critically defective because it did not consider the aquifer's importance as a supplemental source of drinking water where relatively high levels of radium would be diluted to permissible levels by mixing it with the water in current use from the Dead Horse Creek and the White River. This could be accomplished without any treatment at all, as Dr. Valentine commented. When it lost use of the White River, the town of Crawford sought just such a temporary and supplemental source by running a pipe line to Fort Robinson. In view of this event, it would appear reasonable to conclude that the Chadron water could be used as a seasonal and supplemental source of drinking water when the Crawford supply is running short. As noted in the earlier comments, this solution is further supported by the fact that much of the water within the area proposed for exemption by FEN has been shown to be much lower in radium than the levels used by the FEN contractor which used the average of the water within the ore body. The report and analysis of the FEN contractor regarding the potential of the aquifer within the exempted area for use as an usdw must be rejected as insufficient and defective.

WNRC again appreciates the opportunity to comment upon the EPA's consideration of the proposed aquifer exemption. We hope you will agree that the enclosed material is quite significant and requires further investigation and review by the EPA. Please do not hesitate to call upon me if you need further documentation of the Crawford water problem or have any questions concerning the remarks made above.

Sincerely yours,

Andrew B. Reid

Andrew B. Reid
Attorney for Western Nebraska
Resources Council

cc: US NRC
NDEC
WNRC
Sen. Sandy Scofield

Memorandum

DATE: June 27, 1989

TO: David Charlton, Bill Gidley

THROUGH: David Chambers, Dick Ehrman

FROM: Steve Smith

RE: Crow Butte Uranium Project
UIC Permit NE0122611

In response to questions raised about faulting in the vicinity of the Crow Butte Uranium Project near Crawford, Nebraska, I have reviewed some information on a cross section under and east of the surface collection lagoons and reviewed pumping test results. Based on the information available, there is no direct evidence of faulting but there is some strong circumstantial evidence for faulting.

The top of the basal Chadron sandstone is 38 feet higher in Boring A-90 than in Boring A-438. The base is about 29 feet higher. These two borings are separated by about 200 feet. If the basal Chadron sandstone is an undulating bed, then the average slopes are 10.8° and 8.3° for the top and bottom of the bed (which thickens from 46 feet in A-438 to 55 feet in A-90) between the two borings. While these average slopes are not unreasonable for undulating beds, they are about three times greater than for any of the other average slopes for that particular cross section. This may indicate a fault between these two borings. A-438 and A-90 are the two western-most borings for which logs were provided. Extending the section line west to include A-73, B-119, A-39, A-6, A-22, and A-10 could shed additional light on this.

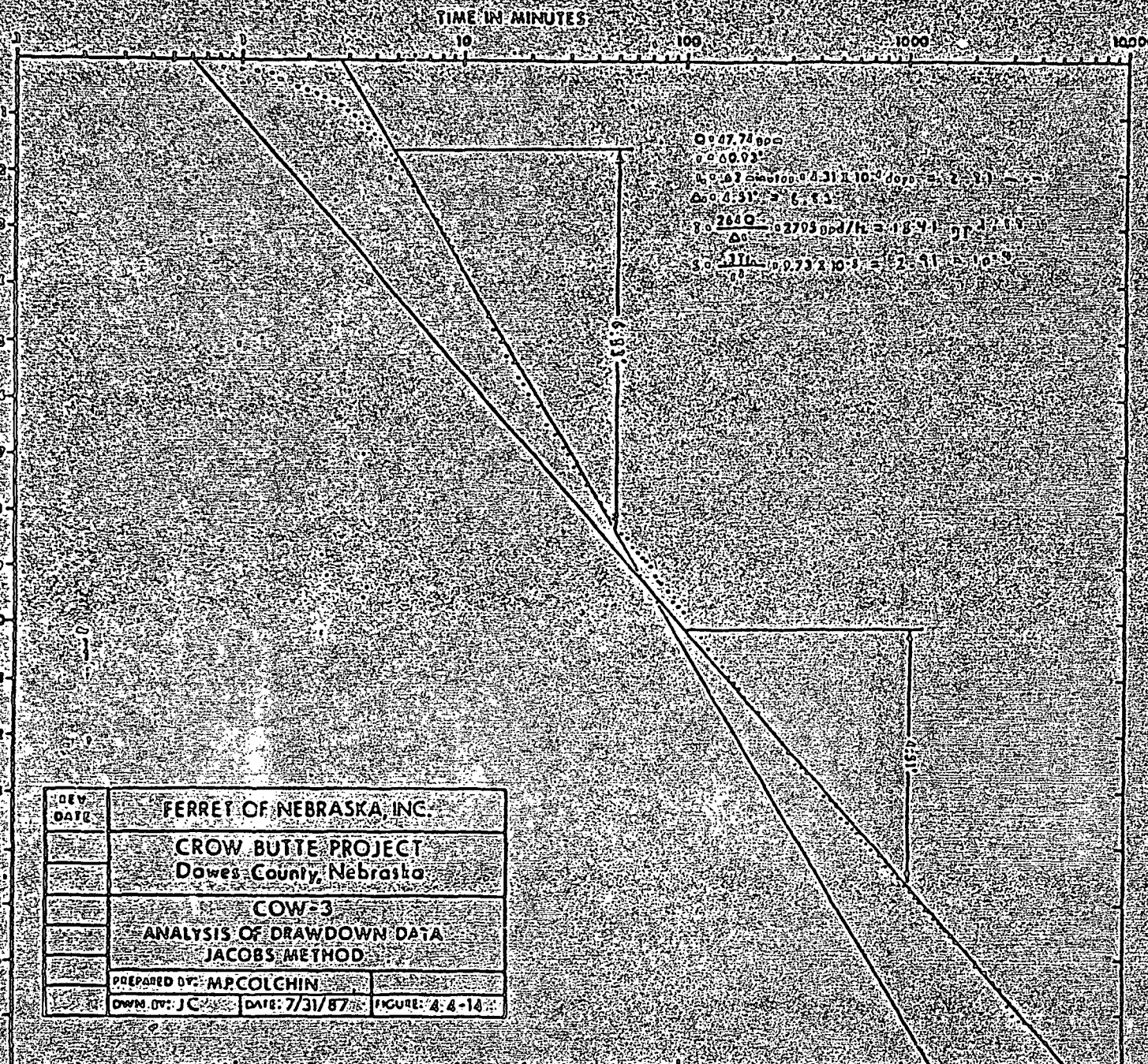
Perhaps more directly indicative of faulting in the area is data from monitoring well COW-3 from the initial pumping test of the basal Chadron sandstone. The data from COW-1 and COW-2 plotted virtually classic semilog drawdown versus time curves for a non-leaking confined aquifer. However, I now disagree with their interpretation of the data from COW-3. A copy of Figure 4.4-14 shows Ferret's interpretation of the data (in black) and my alternate interpretation (in red). According to the Cooper-Jacob technique, after allowing for a period of equilibriation, the first linear trend should be used for the calculation of transmissivity and storativity. I think that the data points between times 4 min 12.38 sec and 29 min 53.13 sec define this trend. The data points for times greater than this elapsed time veer off in a manner that suggests aquifer leakage.

Alternatives to the aquifer leakage were considered to explain the COW-3 data. The only other alternative that could explain the data is

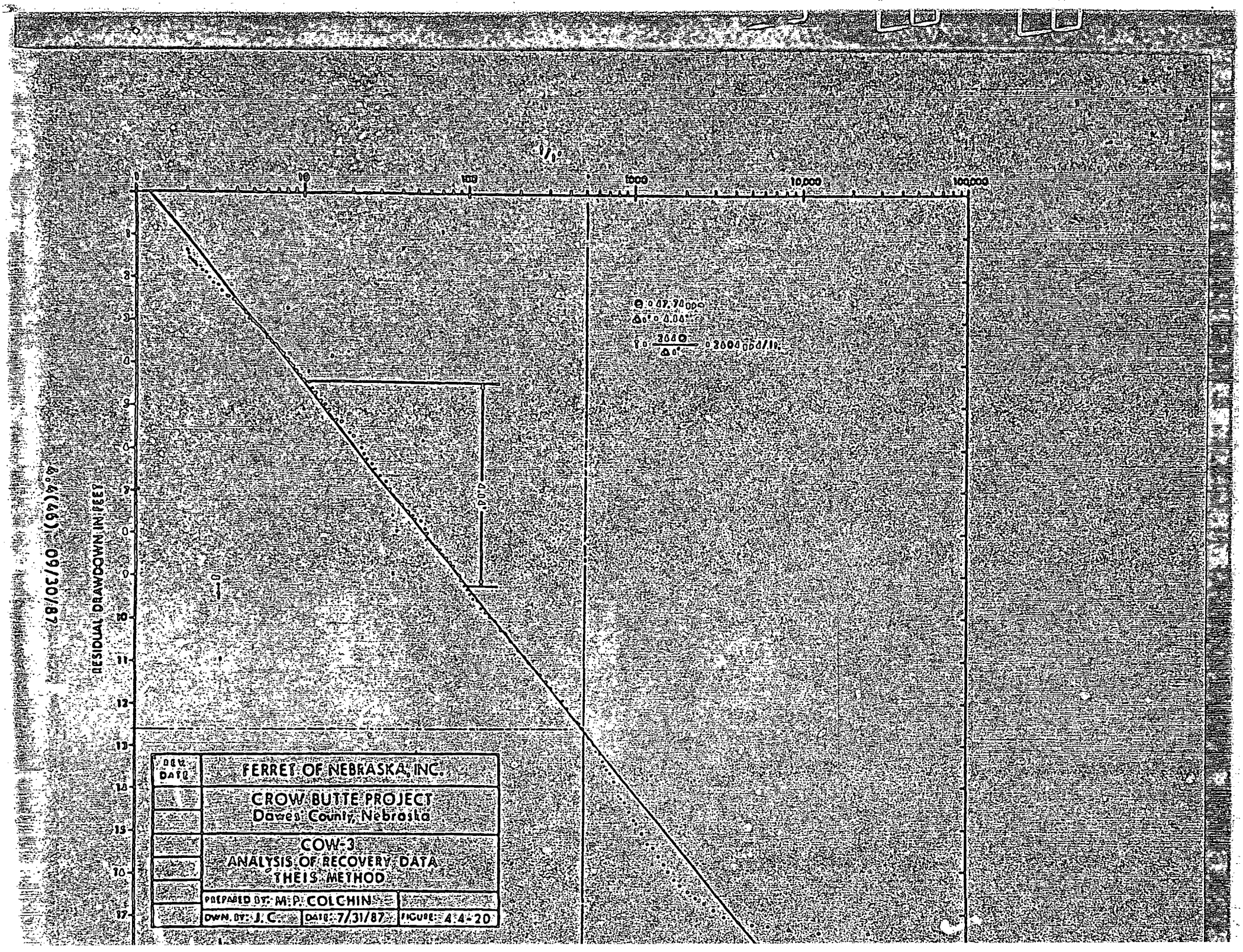
if COW-3 were not properly developed at the beginning of the test. If the well screen was partially blocked, this could slow the flow of water out of the observation well which would appear as the initial lag. As time passed, the pressure gradient inside the well became great enough to clear the well screen and equilibrium was quickly established. The data then followed the expected linear trend after about 200 minutes had elapsed. The problem with this theory is that the recovery period also showed the deviation. It does not seem likely that the clogged screen would effect the first 8.6 min of recovery, as shown in Figure 4.4-20.

Given the presence of the White River fault about 3 miles northwest of the permitted area, it is not surprising that some lesser associated faulting exists in the area as well. The existence of faults is not an a priori reason to deny the operating permit. As long as the faulting is not active, the clay rich upper Chadron and Orella Mbr of the Brule Fm could effectively reseal the faults to provide confinement. However, the apparent leakage from the COW-3 data is a more serious concern. Although the other two wells in the test and the upper and lower confining unit piezometers did not indicate significant leakage, there may be localized areas that could have problems. Monitoring of the upper confining units of operating cells is advised.

SS/dph


TIME IN MINUTES
1
10
100
1000
10,000
DRAWDOWN IN FEET
6.83'
4.51'
Q = 47.74 gpm
Δs = 4.51' = 6.83'
REV
DATE
FERRET OF NEBRASKA, INC.
CROW BUTTE PROJECT
Dawes County, Nebraska
COW-3
ANALYSIS OF DRAWDOWN DATA
JACOBS METHOD
PREPARED BY: M.P. COLCHIN
DWN. BY: JC
DATE: 7/31/87
FIGURE: 4.4-14

09/30/87 (40) 4.6



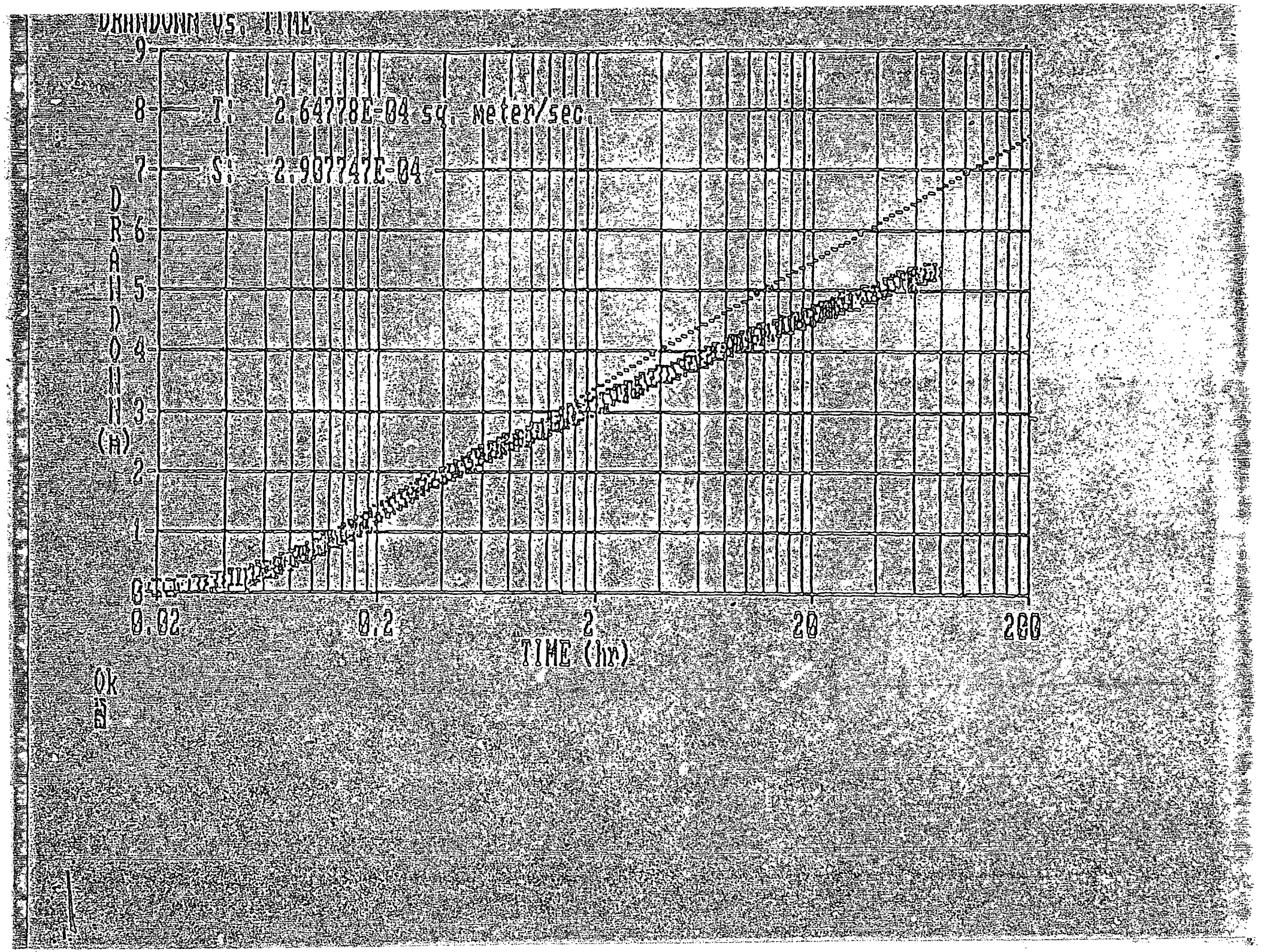
RESIDUAL DRAWDOWN IN FEET
1
10
100
1000
10,000
100,000
4.4(46) 09/30/87
0.04
FERRET OF NEBRASKA, INC.
CROW BUTTE PROJECT
Dawes County, Nebraska
COW-3
ANALYSIS OF RECOVERY DATA
THEIS METHOD
PREPARED BY: M.P. COLCHIN
DWN. BY: J.C.
DATE: 7/31/87
FIGURE: 4.4-20

Pumping rate: 180.7 L/min

Distance to observation well: 18.37 m

Reading No.	Time (hrs.)	Drawdown (m.)
1	0.020	0.046
2	0.023	0.067
3	0.026	0.098
4	0.030	0.134
5	0.033	0.155
6	0.036	0.180
7	0.040	0.193
8	0.043	0.232
9	0.046	0.238
10	0.049	0.271
11	0.054	0.299
12	0.058	0.351
13	0.062	0.366
14	0.066	0.396
15	0.070	0.451
16	0.074	0.469
17	0.078	0.506
18	0.082	0.536
19	0.088	0.594
20	0.094	0.613
21	0.099	0.683
22	0.105	0.719
23	0.110	0.738
24	0.116	0.786
25	0.121	0.844
26	0.127	0.856
27	0.132	0.905
28	0.138	0.942
29	0.143	0.969
30	0.149	1.012
31	0.154	1.061
32	0.160	1.082
33	0.165	1.131
34	0.182	1.201
35	0.199	1.289
36	0.215	1.393
37	0.232	1.457
38	0.240	1.521
39	0.265	1.591
40	0.282	1.637
41	0.298	1.710
42	0.315	1.736
43	0.332	1.804
44	0.365	1.865
45	0.398	1.960
46	0.431	2.015
47	0.465	2.088
48	0.498	2.124
49	0.531	2.194
50	0.565	2.225
51	0.598	2.292
52	0.631	2.329
53	0.665	2.356
54	0.698	2.386
55	0.731	2.438
56	0.764	2.469
57	0.798	2.472
58	0.831	2.518
59	0.881	2.560
60	0.931	2.585
61	0.981	2.633
62	1.031	2.667
63	1.081	2.674
64	1.131	2.710
65	1.181	2.740
66	1.231	2.795
67	1.281	2.827
68	1.331	2.825
69	1.414	2.883
70	1.467	2.932
71	1.581	2.936
72	1.664	2.990
73	1.831	3.070

70	1.[illegible]	2.[illegible]
71	1.231	2.734
72	1.564	2.99[illegible]
73	1.931	3.073
74	1.797	3.118
75	2.164	3.185
76	2.930	3.234
77	2.497	3.286
78	2.664	3.337
79	2.830	3.371
80	2.997	3.398
81	3.164	3.453
82	3.330	3.484
83	3.664	3.532
84	3.997	3.596
85	4.330	3.639
86	4.663	3.709
87	4.997	3.749
88	5.330	3.810
89	5.663	3.837
90	5.997	3.862
91	6.330	3.892
92	6.663	3.947
93	7.163	3.990
94	7.653	4.014
95	8.163	4.048
96	8.663	4.105
97	9.163	4.139
98	9.663	4.166
99	10.163	4.185
100	10.663	4.224
101	11.163	4.249
102	11.663	4.288
103	12.663	4.316
104	13.663	4.383
105	14.663	4.410
106	15.663	4.438
107	16.663	4.477
108	17.663	4.514
109	18.663	4.550
110	19.663	4.572
111	20.663	4.624
112	21.663	4.627
113	[illegible]	[illegible]


DRAWDOWN VS. TIME
T: 2.64778E-04 sq. meter/sec.
S: 2.987747E-04
DRAWDOWN (M)
9
8
7
6
5
4
3
2
1
0
0.02
0.2
2
20
200
TIME (hr)

Ok

Ferret
Exploration
Company of
Nebraska, Inc.

Telephone (303) 295-0238
Telecopy (303) 292-6461

July 13, 1989

RECEIVED
JUL 13 1989
DEPARTMENT OF
ENVIRONMENTAL CONTROL

Mr. Bill Gidley
Nebraska Department of Environmental Control
Box 94877
Lincoln, Nebraska 68509-4877

RE: UIC Permit NE 0122611

Dear Bill:

We received a copy of Steve Smith's memo of June 27, 1989 regarding faulting in the Crow Butte project area. Mr. Smith reports that there is a difference of 29 feet in the elevation of the base of the Chadron sandstone in drill holes A-90 and A-438. FEN is uncertain as to how Mr. Smith arrived at this figure. The surveyed surface elevation of A-90 is 3907.5 feet msl. The base of the Chadron is at a depth of 694 feet or 3213.5 feet msl. A-438 has a surveyed elevation of 3913.4 feet msl. The base of the Chadron is 709 feet or 3204.4 feet msl. The difference in the elevation of the base of the Chadron between these two holes is 9.1 feet, not 29 feet.

As a result of the above problem, FEN is also not sure how Mr. Smith arrives at the conclusion that the top of the Chadron sandstone is 38 feet higher in hole A-90 versus A-438. The thickness of the Chadron sandstone is variable, ranging from 0 to nearly 100 feet in the Area of Review and illustrated in the permit application on Figures 4.5-4 through 4.5-12. As a result of this variation in thickness, the top of the Chadron is not a good marker to indicate faulting.

The slope of the base of the Chadron between A-90 and A-438 is 9 feet in 200 foot or about 2° to the west. The slope of the base of the Chadron is similar along the section line from A-469 to A-90 and from A-438 to A-10.

Mr. Smith offers his interpretation of the aquifer test data from well COW-3. Mr. Smith used the Cooper-Jacobs method to analyze the early drawdown data from COW-3. He states that the data points between times 4 minutes 12.38 seconds and 29 minutes 53.13 seconds should be used to define the linear trend to calculate transmissivity and storativity. He further states that data points for later times suggest aquifer leakage.

FEN disagrees with this interpretation. We believe that the data from COW-3 shows no indication of leakage and that our original interpretation is correct for two reasons. Jacob (Cooper and Jacob, 1964) pointed out that for small values of u (that is, for small r and/or large t) compared to $\log_e u$, the Theis non-equilibrium formula can be modified to the following form without significant error:

$$s = \frac{264\,Q}{T} \left(\log \frac{0.3\,Tt}{r^2 S}\right)$$

Where:

s = drawdown, in feet
Q = pumping rate, in gpm
T = transmissivity of aquifer, in gpd per foot
t = time since pumping started, in days
r = distance, in feet, from center of pumped well to point where drawdown is measured.
S = coefficient of storage, dimensionless

Application of this simplified method should be restricted to values of u less than 0.01 (Davis and DeWiest, 1966). In this test, the value of u for COW-3 is not less than 0.01 until about 35 minutes after the start of pumping. Because of this limitation, use of Jacob's method to interpret data from COW-3 before 35 minutes after the start of pumping is not valid.

Our analysis of the test data for COW-3 by the Theis non-equilibrium method (Theis, 1935) clearly shows that there is no leakage apparent in the data from COW-3. This result is in agreement with that shown by the Jacob method.

We believe the early response of COW-3 during the test is the result of casing storage effects. All of our analyses of the test data indicate that leakage does not occur in area of influence of this aquifer test.

In summary, PEN does not believe there is evidence for any leakage as a result of faulting in the permit area.

If you need any additional information, please contact me.

Sincerely,

Stephen P. Collings

Stephen P. Collings
Vice President

cc: Noel DeKalb
Ralph Knode
Bart Conroy

References:

Cooper, H.H., Jr. and Jacobs, C.E. 1964, *A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Wellfield History*. Trans. Am. Geophys. Union, V. 27, p. 526-534.

Davis, S.N. and DeWiest, R.J.M., 1966, *Hydrogeology*, John Wiley & Sons, Inc., New York.

ANDREW B. REID
Attorney at Law
HC75, Box 33B
Chadron, NE 69337

September 11, 1989

Steven Moeller
Attorney General's Office
2115 State Capitol Building
Lincoln, NE 68509

Re: Crow Butte Project
Alien ownership

Dear Steve:

Please find enclosed some materials I recently received regarding the ownership and control of the Crow Butte Project by the Canadian corporation, Imperial Metals. Note especially that the interests of IMC as stated on page 12 of the 1989 Annual Report extends well beyond the Crow Butte area to include an additional undeveloped project, Big Red, which is estimated to contain nineteen million pounds of uranium reserves and of which IMC holds a 21.04% interest and the Imperial Metals Group holds an 86% interest. The Big Red project also is stated to encompass in excess of twenty thousand acres.

On page 9 of the report in the last paragraph IMC states that the IMC group's land holdings exceed two hundred ten thousand acres in Nebraska with a total resource potential estimated to exceed one hundred million pounds of uranium ore. Finally, note that there is a schematic of the Imperial Metals Corporation ownership and control of subsidiaries and partnerships enclosed as well. That schematic shows a 100% ownership by IMC of Geomex Minerals, Inc., and an 18.7% ownership by IMC of Ferret Exploration Company of Nebraska. The schematic additionally refers to the specific limited partnerships that are associated with Geomex Minerals, these would be Geomex 6 and Geomex 7 limited partnerships.

It is quite obvious from the enclosed materials that the IMC ownership interests of real estate in Nebraska is far in excess of that needed for any "industrial establishment". Please take these materials in to account when reaching your decision regarding the enforcement of the Nebraska alien ownership laws.

Sincerely yours,

Andrew B. Reid

ABR/nm

cc: Secretary of State
Sen. Sandy Scofield
WNRC
VCNRC

MISCELLANEOUS

Imperial Metals -- This company was founded to employ German tax money in the late 1970's when these citizens were allowed to write off over 200% of income against taxes for funds invested in overseas mineral and oil exploration.

Although the company shared in the various projects on an equity basis, over the years the main income of the company has been from management fees from the partners plus the selling off of its share of any significant discovery, particularly in uranium in Saskatchewan. These activities are expected to continue and will produce an annual cash flow of about $2 million, plus periodic large windfalls like the profits from the sale of properties in Saskatchewan.

The company is now entering a period of transition where it is going to become more and more an operating company. Beginning in 1989 it will have a small cash flow from the Apex Copper Gold mine operated by Teck Corporation. Imperial's 2.5% interest will contribute a cash flow of about $300,000 annually. Imperial's Partners with 7.5% will receive close to a million. If all goes well the company expects to be producing uranium in its own right by down-well leaching in Kansas by 1990, which would increase the corporate cash flow to over $4 million in 1991.

The giant leg up to becoming an operating company is expected to occur with the successful bringing into production of the Polly Mountain Gold-Copper porphyry in the Cariboo area. Ownership is shared by Imperial (34%), Imperial Partners (28%), and Corona Inc. (38%). Imperial is the operator. As drilled off for development, ore reserves are:

53,000,000 tons, 0.48% copper, 0.018 o.p.t. gold.

Initial recoveries are indicated to be over 80%. In addition the property has a long term potential for electro winning additional copper from the waste dumps.

The group is aiming to complete a bankable feasibility study by year end. Preliminary estimates are for a 15,000 ton per day operation to produce 30 million pounds of copper and 100,000 ounces of gold. Capital cost is estimated at $135 million. At reasonable metal prices this would throw off an annual cash flow of over $30 million, of which over $10 million would flow through to Imperial when the mine hits full production in 1992.

In addition to its internal cash flow growth, the company expects to have as much again from its interests in Anglesey Mining (37.8%), Catheral Gold (26%) and Colony Pacific (19.2%). All of these companies are moving towards production with mines of their own.

In summary, with the likelihood of Imperial Metals being able to increase its cash flow by ten times in the next four years, the stock is undervalued and should be accumulated for its long term growth.

Anglesey Mining -- Imperial Mining owns 37.8% of this London listed company. The Parys Mountain mine is located on the isle of Anglesey in Whales and has been a mining center for 2,000 years. The Romans mined some; it was again active in the middle ages; and in the 1800's it was the largest copper mine in the world before the Americas and Africa took over. It has been dormant since 1911.

Currently, an underground development is under way to prove up the remaining ore reserves, which by drilling are indicated to total:

7 million tons, 1.47% copper, 5.94% zinc, 3% lead, 0.014 o.p.t. gold, and 2.02 o.p.t. silver.

It is anticipated that this new mine has the potential to add $5 million in cash flow to Imperial in the early 1990's. We are going to visit the property in the near future for a first hand look.

Colony Pacific -- Imperial Metals owns 19.2%, and Westmin Resources 29.1% plus a 2.5% net profit interest in this California ore body. Imperial is the operator. The company is in the process of obtaining the licensing to conduct a $10 million underground development program to prove up the ore body for mining.

The ore grades are very similar to those at Westmin's Buttle Lake mines and are indicated to total:

4.1 million tons, 1.1% copper, 9.57% zinc, 0.44% lead, 0.061 o.p.t. gold and 2.53 o.p.t. silver.

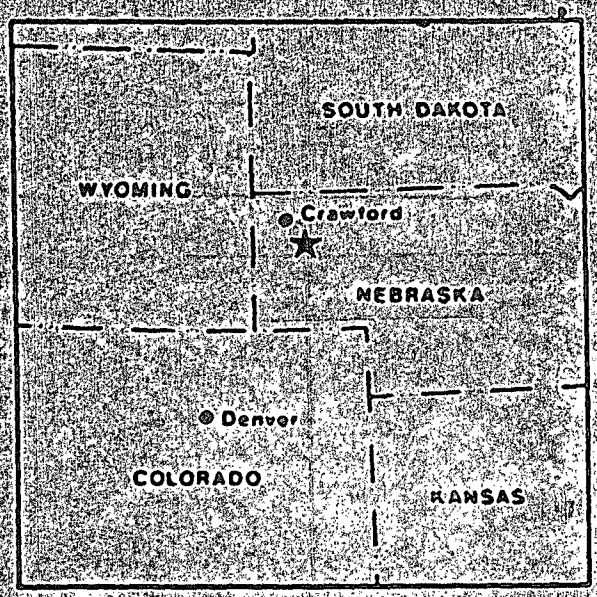
The stock is a long term start-up speculation with a history of good trading opportunities for patient investors.

Cathedral Gold -- Imperial owns 26% of this company which is used as its vehicle to explore for and mine gold. At present, the company has an annual production of about 5,000 ounces from its 50% ownership in the high grade leaching operation of the Sterling Mine, north of Las Vegas, Nevada.

At this time the Porcher Island Mine in Alaska is its most likely new producer. Ore reserves now total over 2 million tons of 0.2 o.p.t.

Imperial Metals Corporation

CROW BUTTE



Commodity: Uranium

Ownership: 65% Imperial Metals Group
25% Uranerz
10% Kepco

Operator: Ferret Exploration Company of Nebraska

Reserves: Estimated 44,000,000 lbs U_3O_8

Grade: 5.2 lbs U_3O_8/ton

Mining Method: In situ leach

Production Capacity: 1,000,000 lbs/year estimated

Capital Cost: Estimated $10,000,000

Status: Commercial permit application submitted. Production within one year of permit receipt. Pilot plant currently in operation.

Location: The Crow Butte uranium deposit is located in the northwestern portion of the Nebraska Panhandle in Sioux and Dawes Counties. The property consists of 27,000 acres under lease. The town of Crawford with a population of 1300 is located nearby.

Geology The sedimentary strata ranges from the late Cretaceous Pierre shale through Tertiary aged sediments and Pleistocene alluvium.

Exploration and Reserves In excess of 2500 holes totalling 1,781,000 feet have been completed on the property since 1979. 85 holes and 86,000 feet were completed in 1987 and 156 holes and 148,000 feet in 1988. Present indicated reserves are estimated at 44,000,000 lbs U_3O_8 at a grade of 5.2 lbs U_3O_8/ton. Numerous ore grade drill intersections outside present reserves provide potential for major extensions.

Technology The pilot plant at Crow Butte uses an in-situ mining process. A mild solvent is pumped down into the formation which hosts the uranium bearing material. The solution dissolves the uranium and is recovered through wells located in a circular pattern around the point of injection. The solution is then pumped through an ion exchange plant where the dissolved uranium is removed and the barren solvent is recycled back into the formation via the injection wells. This mining method does not disturb the surface and there are no tailings. There is no mine water disposal or demand on ground water due to the constant recirculation of fluid.

1989 Program The pilot plant has now been operating trouble-free for 30 months and will continue to run until it is merged with the full scale production plant. As a result of the U.S. Nuclear Regulatory Commission issuance of draft finding of no significant impact for public consideration, the Company expects commercial permitting to be completed by mid-1989. This will pave the way for commencement of full scale production by mid-1990.

12g3-2(b) : 82-1032
TSE/MSE/VSE: IPM

MARCH, 1989

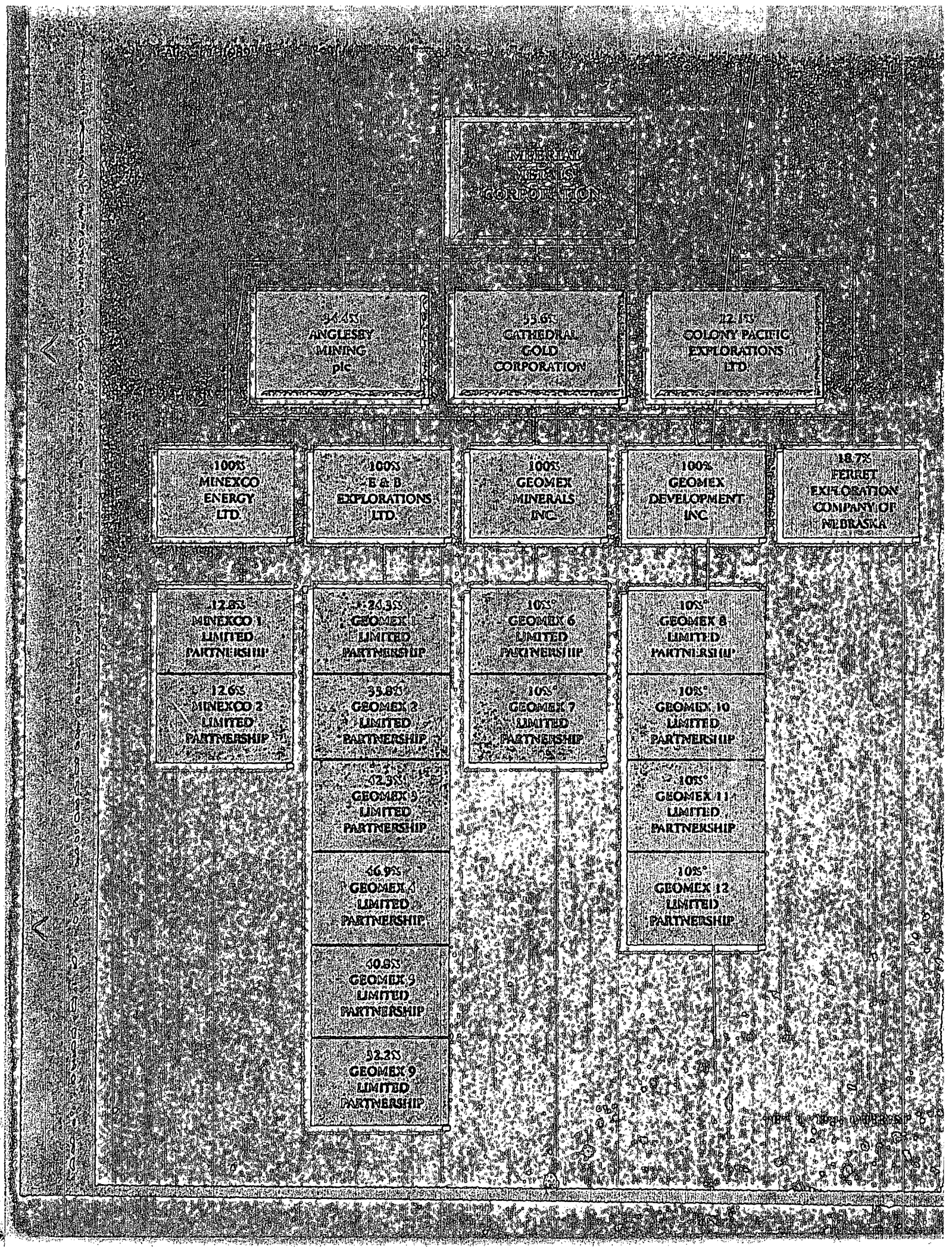
Imperial Metals Corporation

	1989	1988	1987	1986	1985
FINANCIAL HIGHLIGHTS					
Revenue	4,093,000	3,877,000	3,348,000	4,124,000	3,973,000
Net Income	3,041,000	2,082,000	1,269,000	2,234,000	2,229,000
Cash Flow	650,000	2,082,000	1,501,000	2,915,000	1,972,000
Net Book Assets	24,816,000	20,800,000	19,604,000	18,026,000	15,578,000
Working Capital	526,000	3,714,000	3,947,000	2,960,000	2,190,000
SHARE DATA					
EPS	0.190	0.111	0.079	0.159	0.161
Working Capital	0.03	0.22	0.26	0.68	0.30
Book Value	1.45	1.27	1.16	1.06	0.89
MARKET VALUES					
High	1.53	1.50	1.35	1.55	1.50
Low	0.72	0.80	0.85	0.94	0.78
Close(1)	1.05	0.96	1.12	1.30	0.89
RATIOS					
Price/Earnings(2)	5.52	8.65	14.18	8.18	5.53
Current	1.21	2.51	2.34	4.38	2.74
Debt/Equity	0.03	0.01	0.02	0.03	0.07
Market/Book(2)	0.72	0.76	0.97	1.23	1.00

(1) At Fiscal Year End, 31 March
(2) Based on closing price

Note: At August 18, 1989 closing price $Cdn $1.47 - P/E is 7.73.

IPM : TSE - MSE - VSE


IMPERIAL METALS CORPORATION
94.4% ANGLESBY MINING plc
53.6% CATHEDRAL GOLD CORPORATION
42.1% COLONY PACIFIC EXPLORATIONS LTD
100% MINEXCO ENERGY LTD
100% E & B EXPLORATIONS LTD
100% GEOMEX MINERALS INC
100% GEOMEX DEVELOPMENT INC
18.7% FERRET EXPLORATION COMPANY OF NEBRASKA
12.8% MINEXCO 1 LIMITED PARTNERSHIP
12.6% MINEXCO 2 LIMITED PARTNERSHIP
24.3% GEOMEX 1 LIMITED PARTNERSHIP
33.8% GEOMEX 2 LIMITED PARTNERSHIP
42.3% GEOMEX 3 LIMITED PARTNERSHIP
46.9% GEOMEX 4 LIMITED PARTNERSHIP
40.8% GEOMEX 5 LIMITED PARTNERSHIP
52.2% GEOMEX 9 LIMITED PARTNERSHIP
10% GEOMEX 6 LIMITED PARTNERSHIP
10% GEOMEX 7 LIMITED PARTNERSHIP
10% GEOMEX 8 LIMITED PARTNERSHIP
10% GEOMEX 10 LIMITED PARTNERSHIP
10% GEOMEX 11 LIMITED PARTNERSHIP
10% GEOMEX 12 LIMITED PARTNERSHIP

MINERAL PROPERTIES

- Record net income of $3,183,000 (19.0 per share)
- Initiated [illegible] year of profits
- 27% increase in long-term assets
- High-grade ore zones defined at Mount Polley, [illegible] 53,000,000 tons grading [illegible] copper and [illegible] oz/t gold
- Market value of affiliates rises dramatically

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Shaft at Pays

DIRECTORS' REPORT TO SHAREHOLDERS

It is a pleasure to report on our best year ever in terms of net income, asset growth and development activities. Earnings per share climbed to a record 19¢ on net income of $3,183,000. Operating revenues were up 6% to $4,095,000 while operating expenses increased 21% to $4,023,000 reflecting the Company's broadening scope of activities. Mineral exploration and development expenditures for the entire Imperial Metals Corporation Group were $14,300,000, an increase of $4,500,000 over 1988 levels. The Group's oil and gas acquisition, exploration and development expenditures were $3,400,000, up $2,600,000 from last year.

Long term assets increased 37% to $29,764,000 depleting cash at year end. Cash was subsequently replenished by a fully subscribed $4,850,000 rights offering and by the sale of 9% of the Company's equity position in Anglesey Mining plc for proceeds of $1,526,000.

Fiscal 1989 was Imperial's fifth consecutive year of profitable operations. This is particularly significant when it is considered that Imperial has primarily been a mineral explorer throughout this period and has remained debt free while advancing to a point of transition where a number of its key mineral properties have reached the development stage. Imperial's strong balance sheet is due in part to its strategy of spinning off certain projects into affiliated companies where appropriate, thus creating single purpose enterprises whose mission and value can readily be identified and measured. When we reported last year on the creation of Cathedral Gold Corporation, the launching of Anglesey Mining plc and developments within Colony Pacific's excellent portfolio of polymetallic properties, the market value of the Company's equity position in these affiliates was $4,704,000. It had risen to $18,488,000 by year end and at the time of writing the market value was $26,940,000 or $1.27 per Imperial share!

Diversity, successful trading activities and workable financing strategies have been the key elements of our continued growth and profitability. As we enter the 1990's Imperial stands as a company in transition from mineral explorer to a diversified mineral producer. Developments at our key projects in the next few years should provide Imperial with participation in copper and gold production in British Columbia at the Ajax, Mount Polley and Porcher Island properties, in uranium production in Nebraska at Crow Butte, and in copper, lead and zinc production at Parys Mountain in the U.K. and at Blue Moon in California.

The success of any enterprise depends on the talent, skill and dedication of its people. We wish to take this opportunity to recognize their contributions during the year and their continuing efforts on behalf of the Imperial Group.

Outlook

The company is often asked about its commodity price expectations. We usually caution that no one can consistently and accurately foretell prices because they can be greatly affected by unpredictable events. Successful resource companies never base their decisions solely on commodity price forecasts nor on short-term fluctuations. Many other factors, including those relating to the competitive advantage of one resource development over another, are always taken into consideration.

In the past few years, the world has witnessed sudden and sometimes dramatic movements in resource prices. Many of us sense that resource prices are now entering into a period of relative stability. Starting with base metals, although we feel it is unlikely that prices, especially in the case of copper and nickel, will remain at current levels, we also feel it is unlikely that they will return to the very depressed levels of 1985 and 1986 when few metal mines in the Western World were profitable and when it was very difficult to bring new production on stream. Moving to gold, it must be recognized that it has currently lost much of its attraction for many speculative investors. This situation may be temporary. Gold loan financing and forward selling by producers accelerated supplies by an estimated 12-15,000,000 ounces in 1988, while traditional price stimulants such as record government deficits, Third World debt, the looming U.S. savings and loan crisis, the persistent fear of inflation and a generally weak U.S. dollar are still very much a part of the present gold market. We expect gold to establish trading patterns between $350 and $450 U.S. in the next few years. On the energy side, the uranium market reminds us very much of the copper market of a few years ago. For the last three years, consumption has exceeded production and inventories are falling below levels considered appropriate for the orderly flow of this commodity to its end users. Record low spot prices are well beneath the average cash cost of production of most producers, some of whom are finding it attractive to suspend production and rely upon spot market purchases to deliver on their existing contracts. The current situation cannot go on much longer, especially in light of the O.E.C.D.'s recent prediction for a 3.8% compound annual growth in nuclear power to the year 2000. Uranium prices will soon be heading up. As for oil and gas, we feel that the current price ratio will shift in favor of gas as a direct result of the Free Trade Agreement between Canada and the United States. The Agreement assures the U.S. of reliable and steady gas supplies from Canada and this will encourage investors to commit the funds required to upgrade and expand existing pipeline distribution facilities. Environmental concerns will also encourage the replacement of oil by gas as an energy source. We expect to see oil at $15 to $20 per barrel and gas steadily increasing in price over the next three years.

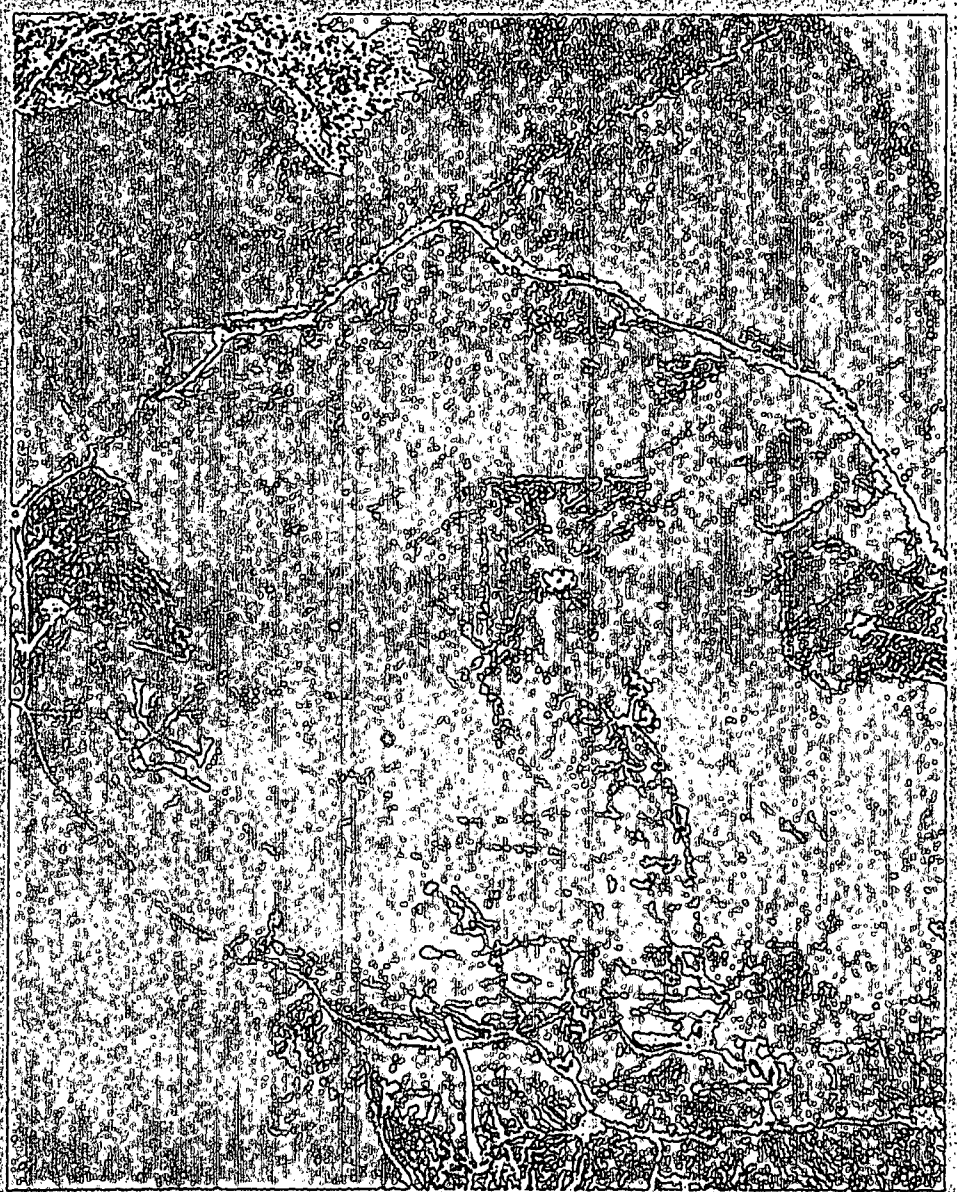
Dr. Hugh C. Morris
Chairman
Chief Executive Officer

Pierre B. Lebel
President
Chief Operating Officer

GENERAL

Imperial Metals Corporation is a diversified natural resource company based in Vancouver British Columbia. Its shares are listed for trading on the Toronto, Montreal and Vancouver Stock Exchanges under the trading symbol IPM. In addition to its own properties, Imperial manages an extensive resource property portfolio on behalf of 14 private limited partnerships and three public companies. The fair market value of assets under management is estimated to exceed $150,000,000. These are located in Canada, the United States, the United Kingdom and Mexico.

Imperial's head office is in Vancouver, British Columbia. The Company also maintains an office in Calgary, Alberta and it's U.K. affiliate, Anglesey Mining plc, maintains an office at the Parys Mountain mine site in North Wales. Imperial provides a wide range of management administrative, financial and technical services to all members of the Imperial Group. Permanent head office staff numbers 40.



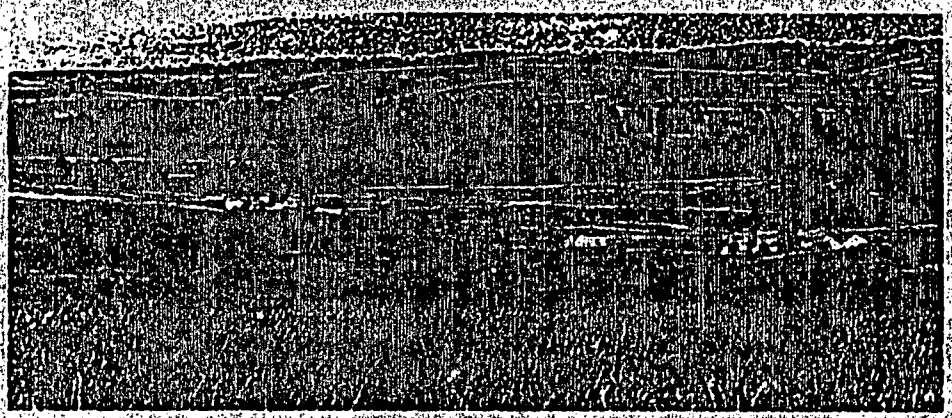
Mount Polley Project

The Crow Butte in-situ leach pilot plant located in Western Nebraska has operated flawlessly for three years successfully establishing that U_3O_8 can be commercially produced at a cash cost below currently depressed spot market prices and well below long-term contract prices. A 2,500 gallon per minute commercial plant, capable of producing 1 million lbs U_3O_8 per year, has been purchased and delivered to the site.

Because Crow Butte will be the first operating uranium mine in Nebraska, the permitting process, ongoing since October 1987, has moved along slowly. Issuance of the required permits now awaits a ruling on the joint venture status under Nebraska Foreign Ownership laws and execution of a low level radioactive waste disposal agreement. These matters should be resolved by the Fall of 1989 allowing production to begin in calendar 1990.

Recent exploration in the Crow Butte area has added some 11,000,000 lbs of reserves in all categories. With more than 1,800,000 feet drilled in 2500 holes since 1979 the Crow Butte geological inventory now exceeds 55,000,000 lbs U_3O_8.

The 20,000 acre Big Red project abuts the Crow Butte property to the south. It hosts in excess of 19,000,000 lbs U_3O_8 in all reserve categories, based on 688,000 feet of drilling in 637 holes. Drilling in 1989 will exceed 100,000 feet.



Drilling at Big Red

Work was also carried out on the Keota and Grover properties located in northwestern Colorado. These deposits offer excellent in-situ solution mining characteristics at very favorable depths. Reserves are presently estimated at 10 million lbs U_3O_8 with good potential for expansion.

The Imperial Metals Corporation Group's land position in the Crow Butte region exceeds 210,000 acres. The total resource potential is estimated to exceed 100,000,000 lbs of U_3O_8. With its impressive portfolio of low cost in-situ leach uranium deposits the Imperial Group is well positioned to benefit from expected medium term improvement in uranium prices.

PRINCIPAL RESOURCE HOLDINGS

At August 1, 1989

Base and Precious Metals

PROJECT	LOCATION	GROUP INTEREST %	IMC INTEREST %	RESERVES tons	AU OZ/T	AG OZ/T	CU %	ZN %	PB %	OZ AU IN GROUND TO IMC
AJAX	B.C.	9.00	1.80	27,200,000	0.010		0.46			5,000
MOUNT POLLEY	B.C.	61.59	33.64	53,000,000	0.017		0.44			303,000
PAREDONES AMARILLOS	MEXICO	49.00	23.10	3,100,000	0.070					50,000
ANGLESEY MINING PLC	WALES	48.41	34.40	5,284,000	0.013	2.02	1.49	6.04	3.03	23,000
PARYS MOUNTAIN										
CATHEDRAL GOLD CORPORATION										
ADDINGTON	ONT.	100.00	33.60	785,000	0.130					34,000
BRALORNE	B.C.	42.46	11.91	1,064,000	0.260					33,000
PORCHER ISLAND	B.C.	100.00	33.60	1,500,000	0.200					101,000
STERLING MINE	NEV.	62.00	18.47	469,000	0.210					18,000
TAKLA RAINBOW	B.C.	100.00	33.60	321,000	0.250					27,000
COLONY PACIFIC EXPLORATIONS LTD.										
BLUE MOON	CALIF.	26.00	22.10	3,815,000	0.051	2.44	1.09	7.87	0.46	43,000
TOTAL GOLD RESERVES (OZ)										637,000
TOTAL COPPER RESERVES (LBS)										232,000,000
TOTAL ZINC RESERVES (LBS)										352,000,000

Uranium

PROJECT	LOCATION	GROUP INTEREST %	IMC INTEREST %	RESERVES (lbs)	LBS/TON U_3O_8	IMC U_3O_8 (lbs)
Big Red	Nebraska	86.00	21.04	19,000,000	4.0	4,000,000
Crow Butte	Nebraska	65.00	18.70	55,000,000	5.2	10,300,000
Keota	Colorado	100.00	34.64	10,000,000	2.5	3,400,000
TOTAL U_3O_8 (LBS)						17,700,000

Oil and Gas

	OIL (Bbl)	NAT. GAS LIQUIDS (Bbl)	GAS (mcf)	SULPHUR (tons)
Proven, Developed, Producing	690,500	-	1,636,000	-
Proven, Developed, Non Producing	-	-	324,000	-
Proven, Undeveloped	-	-	2,659,000	-
Probable	133,000	49,200	983,000	8,000
TOTAL RESERVES	823,500	49,200	5,602,000	8,000

Coal

PROJECT	LOCATION	IMC INTEREST %	Tons
Merritt	B.C.	100.00	5,600,000
Tulameen	B.C.	100.00	7,300,000
TOTAL COAL RESERVES (TONS)			12,900,000