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THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF MINES AND PETROLEUM RESOURCES
VICTORIA

October 28, 1970

Union Oil Company of Canada Limited
335 - 8th Avenue, S.W.
Calgary 2, Alberta

Attention: Mr. J.T. Duree

Dear Sir:

Re: MPR, Crush Unit #1

Further to our recent correspondence on the subject, the waterflood MPR has now been finalized at 1383 STBOPD, as detailed on the attached form 9A. The MPR applied for was 1483 STBOPD, and reasons for the downward adjustment are principally due to our use of a lower value for average porosity and a higher value for average water saturation. All parameters were discussed at length when your Messers C. Cracknell and Yu-Lin Lu visited this office on October 15, 1970.

The porosity value used by Union was 19.6%, being the average for all cored wells. However, some wells were not cored and inclusion of sonic-log-derived data from these results in the lower value of 18.5% used in our calculations.

In the case of water saturation, our value of 17% was derived from induction log readings. Union's value of 11.3% was obtained from a correlation of porosity with water saturation derived from capillary pressure and oil-base core data from cores in the Milligan and Peejay Fields. As discussed with your people on October 15, 1970, we do not consider that these data, as presented on Figure 13-C of Union's pressure maintenance submission, yield the most reasonable interpretation of the fluid saturation in the reservoir. The following observations led to our conclusion:

a) The oil-base core data from d-58-E/94-A-16 (Peejay) were obtained from some 3 1/2 feet of material, located approximately 60 feet above the oil/water contact. Judging from the core description accompanying the core analysis report, the rock was dolomite, not sandstone. Correlation of water saturation values from the oil-base core and from induction log data

indicates reasonable agreement, with the exception of one very low permeability plug. In view of the liklihood that mobile water would be flushed from the core by drilling fluid, this correspondence could be expected at such an elevation above the oil/water contact.

b) Capillary pressure data were obtained from four core-plugs in each of d-63-G and d-74-G/94-H-2. These data, at a capillary pressure in the laboratory of 20 psi, are included in your Figure 13C. However, if the oil/water contact in Milligan is taken to be 1200 feet ss and the volume mid-point of the reservoir is 1170 feet ss, then the corresponding capillary pressure at laboratory conditions would be 6psi. Use of the data at this pressure indicates an average water saturation in Milligan of 15.4%, compared with a weighted average value of 16.0% from induction log data. Bearing in mind the inaccuracies implicit in applying an average capillary pressure curve, we consider such agreement to be well within the range of experimental error. The cored interval in d-63-G was not logged. However, logs were run over the cored zone in d-74-G, and there is excellent correlation between log-derived saturation data and those derived from capillary pressure data, corrected for true depth.

c) The oil-base core saturation data obtained from d-63-G are plotted on your Figure 13C. Correlation of these with the depth-corrected capillary pressure data obtained from the same core indicates higher water saturations from these latter data in all instances. This suggests that mobile water was flushed from the rock during the coring process.

We conclude from the above that, in the Halfway formation, water saturations derived from logs or capillary pressure data (at the appropriate depth) yield results that are representative of true reservoir conditions, while oil-base core water saturations err on the low side when mobile water is present. Specifically with respect to Crush, no oil/water contact is detectable, so true capillary pressure is subject to interpretation. Consequently we consider the log-derived average saturation of 17% to be most appropriate for use in the MPR calculation.

If you have any questions please contact us.

Yours truly,

A. J. Dingley
Senior Reservoir Engineer

AJD:lhh

cc WLI