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Texas A & M University
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ELECTROMAGNETIC WAVE PROBING FOR SALT DISCONTINUITIES

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CHAPTER I

INTRODUCTION

Chapter II discusses some further research on our ability to detect boreholes penetrating salt. This research in its initial stage, was discussed in our last report. Chapter II of this report covers the additional research effort made to locate more precisely the discontinuity in the electrical permittivity of the salt due to the presence of the borehole. An improved radar system not only duplicated our last experimental results, but also successfully found additional discontinuities (at least four in the general vicinity of the borehole) which represent hazards to the Grand Saline salt mine, *if*, mining were to proceed in that direction.

Chapter III discusses further research in our ability to detect tunnels beneath salt floors with our CW FM radar system known as ECHO I. Because of the proximity to the end of this tunnel beneath the salt floor, the data were inconclusive and another area in the Grand Saline mine will be visited in the future to reaffirm our tunnel detection capabilities.

Chapter IV reports on our continued measurements of the dielectric properties of salt samples. Through the courtesy of Morton Salt Company's Woodstock, Illinois Laboratories, we have obtained some pressed disks of salt that aid our research very materially insofar as sample preparation is concerned.

Chapter V reports on our acquisition (a gift from the Chevron Oil Field Research Laboratory) of a slotted coaxial line to measure the electrical properties of salt at various frequencies. Unfortunately the samples must be in the form of right circular cylinders with holes in them in order to fit the coaxial line. This may be a problem, but this dielectrometer is the best available for low loss materials such as salt.

The Appendices contain the errata in the last report (A), a literature search (B), the results of a review of Appendix B (D), a theoretical calculation (C), a few documentary data (E, F, and G), and Personnel and Budget Changes (H).

where e_1, e_2, t_1, and t_2 are as defined above and ω is 2π times the resonant frequency of the circuit. It appears that possibly a resonating circuit, containing our low loss salt sample, could be allowed to "ring" (oscillate) for a long enough time $(t_2 - t_1)$ to obtain easily measurable values of the voltages, e_1 and e_2. Then, with the salt sample removed, perhaps again a sufficient amount of time could be allowed to pass so as to make the voltages easily measurable. Possibly this would then allow the values of Q, with and without the salt sample, to also be measurable quantities.

Summary

To date, no method has been found which would be a major improvement over our present method. Although some of the authors make some very interesting claims (see review number three above) of measuring values of tan δ of 10^{-4} with accuracies of $\pm 5 \times 10^{-6}$, review of the paper reveals either these claims are unsupported or for some other reason the idea is not a sufficient improvement over our present method to warrant further work. It appears that we are presently using methods and equipment which are equal to the best that anyone else has available.