DOCKET NO. 027

RAILROAD COMMISSION OF TEXAS

APPLICATION OF ANACONDA COPPER COMPANY
FOR SURFACE MINING AND RECLAMATION
PERMIT: RHODE RANCH PROJECT,
McMULLEN COUNTY, TEXAS.

TO THE HONORABLE RAILROAD COMMISSION OF TEXAS:

PREPARED TESTIMONY OF

ED REED & ASSOCIATED, INC.

Robert Wilson
C. Morris Davis

ATTORNEYS FOR APPLICANT

PREPARED TESTIMONY OF ED REED & ASSOCIATES, INC.

1. Q. Please state your name, title and affiliation.

   A. My name is Ed L. Reed. I am the President of Ed L. Reed and Associates.

2. Q. Please list your professonal qualifications and experience.

   A. See Exhibit A annexed hereto.

3. Q. Have you been asked by Anaconda to perform a study with respect to Anaconda's Rhode Ranch project?

   A. Yes.

4. Q. Can you describe what your work has been?

   A. We were asked to investigate and to prepare a report upon groundwater occurrences and subsurface conditions affecting the planned tailings disposal program outlined by the company in their application for a uranium surface mine permit. Specifically, our report addresses the geohydrologic framework of the Rhode Ranch project and evaluates the tailings disposal as it fits into the geohydrologic conditions at the site.

5. Q. Do you agree with the descriptions of the locations of the site previously stated in the record?

   A. Yes. The Rhode Ranch project lies in southeastern McMullen County, Texas, approximately five miles north of the Duval County line and five miles west of the Live Oak County line. The project is in a sparsely populated portion of South Texas approximately 20 miles southwest of George West and 30 miles northwest of Alice, Texas, the two largest nearby towns.

6. Q. In your investigation did you examine generally the topography and drainage in the vicinity of the Rhode Ranch project?

   A. Yes. The Rhode Ranch lies on gently undulating terrain that regionally slopes northward toward the Nueces River. Most of the Rhode Ranch surfaces drain towards Hill Creek and thence into the Nueces River.

7. Q. Will the surface drainage be changed following reclamation after mining?

   A. No. The surface topography will be restored as closely as possible to the present drainage. Two minor drainage ways transect the proposed mining area and these ways will also be restored to their pre-mining configuration.

8. Q. Can you summarize what your investigation showed about the geology in the vicinity of the site?

   A. The mineralized sand from which the uranium will be extracted lies within two sand beds in the Oakville Sandstone. The Oakville formation is largely exposed at

the surface of the Rhode Ranch although small outliers of the Goliad sand have been mapped in the vicinity. The Oakville has been subdivided locally into three members. From the oldest to the youngest they are the Rincon, the Manuel and the Magnolia. An examination of an exploration pit wall within the project site shows that the lower part of the Magnolia consists largely of cross-bedded fine sands. The underlying Manuel member which is approximately 40 feet thick, consists of yellow virtually silt-free clay in the upper part and a fine to medium grained, gray sand in the lower part. The Rincon which is about 40 feet thick in the northeast and absent in the southwest is predominately clay in the upper portion and fine to medium grained gray sand in the lower portion.

On the east side of the Rhode Ranch the lower sand of the Rincon member rests directly upon the Catahoula clay. On the western portion of Rhode Ranch the Rincon member pinches out and the Manuel member rests directly upon the Catahoula.

The western limit of the Oakville lies approximately two miles west of the mine site. The Oakville thickens to about 500 feet in the vicinity of the McMullen-Live Oak County line.

The Catahoula consists principally of tuffaceous clays and tuff with alternating fine to medium tuffaceous sand and sandy clay. In the vicinity of the Rhode Ranch the Catahoula dips to the east at a rate of approximatly 35 feet per mile.

A northeast trending normal fault lies about a mile southeast of the proposed site. This fault which has a displacement of approximately 60 feet is downthrown on the southeast side. Two minor splinter faults are recognized at the northeast end of this fault. East of the fault the Catahoula dips toward the east at a rate of approximately 80 feet per mile. West of the fault the Catahoula dips easterly about 35 feet per mile.

9. Q. If I understand the geology then, at the Rhode Ranch the Oakville is at the surface and, underlying the Oakville is the Catahoula. Is that correct?

   A. Yes.

10. Q. What did you do to determine the groundwater hydrology in the vicinity of the project?

   A. An inventory was made of the water wells in the vicinity of Rhode Ranch in late 1977. This inventory was updated for the current study which was dated April, 1980.

11. Q. What did the study of the wells reveal?

   A. As has been noted, the Oakville-Catahoula contact lies approximately two miles west of the mine area. Thus, it was expected that the western edge of the Oakville would be thin and unsaturated. Exploration drilling and the construction of the bulk sample pit has shown indeed that the Oakville in the area west of the fault identified above is unsaturated.

12. Q. Is the proposed mine area west or on the upthrown side of the fault you described?

A. Yes.

13. Q. On the west or upthrown side of the fault, are there any wells?

A. Yes.

14. Q. What is the quality of the water in those wells?

A. The Catahoula water is rather poor with chlorides generally exceeding 1,000 milligrams per liter. The easternmost Catahoula wells produced water with chlorides in excess of 2,000 milligrams per liter. The sulfates usually exceed 500 mg/l. In the vicinity of the mine, the shallowest Catahoula sand lies 500 feet below the Catahoula-Oakville contact. This 500 foot interval is comprised principally of clay. Thus the Oakville in the vicinity of the mine project is hydraulically separate from the Catahoula aquifers.

15. Q. Are there wells completed in the Oakville Sandstone?

A. A few wells are completed in the Oakville on the east or downthrown side of the fault. The nearest of these wells to the mine is about 1.5 miles to the east.

16. Q. What is the quality of the water in the Oakville wells?

A. The water produced from the Oakville is somewhat better quality than that produced from the underlying Catahoula although some poor quality water does exist. Chloride concentration of water in the Oakville is as low as 500 mg/l and can be in excess of 4,900 mg/l.

17. Q. What other hydrologic data are available for ground waters in the vicinity of the site?

A. Hydrologic data such as permeability, transmissivity, and porosity are scant for the aquifers in southeast McMullen County. The sparsity of data is due to the low interest in the local aquifers because they generally have low yields of only poor quality water. Pump tests conducted by Anaconda on wells completed in the Oakville near the Live Oak-McMullen County line indicate that the Oakville has a low transmissivity of only about 100 gallons per day per foot. In contrast with that, throughout much of Live Oak County the Oakville is a major aquifer with transmissivities ranging from 1,000 or 2,000 to over 50,000 gallons per day per foot. However, the Oakville which is a major aquifer in Live Oak County is unsaturated in the vicinity of the Rhode Ranch project. In the vicinity of the mine, the Oakville sands are so shallow that they remain drained of recharge waters whereas, to the southeast of the mine, the Oakville sands are apparently displaced to depths where they are allowed to remain saturated.

18. Q. Are there any formations below the Catahoula which might yield water?

A. The Eocene-Age Carrizo sand which even at considerable depths often carries fresh to moderately saline water is

in excess of 7,000 feet below the surface at the site and probably contains water that is quite saline. The Eocene-Age Queen City, Yegua and Jackson, which are fresh water aquifers in western McMullen and LaSalle Counties are deeply buried in southeastern McMullen County and contain saline water.

19. Q. Are you familiar with the proposal of Anaconda for tailings disposal in the pits following mining?

A. Yes.

20. Q. In your investigation did you consider whether the proposal for tailings disposal of Anaconda would prevent pollution and prevent the tailings from being a health or safety hazard?

A. Yes, I concluded that the proposed method of disposal would protect ground and surface water from all material risks of pollution and will not now or in the future present a hazard to health or safety.

21. Q. What types of analyses did you make in forming your conclusion?

A. We examined the characteristics of the soils at depths where they were expected to be found to determine if there would be any impact on the groundwater by the disposal method outlined by the company.

22. Q. What did you discover?

A. The grain size distribution and permeability of the Catahoula clay, which underlies the lowest sand to be mined, ranges from 1.7×10^{-7} to 2.5×10^{-11} centimeters per second indicating that the clays are practically impervious. The low permeabilities are the result of the high percentage of fine-grained material indicated by the sieve analyses which show that 95-100 percent of the material passes a 200 mesh sieve. Consequently, the impervious clays of the Catahoula will restrict downward migration of any fluids from the tailings.

23. Q. Did you examine overburden for its characteristics?

A. Yes. The overburden which was stockpiled during the excavation of the bulk sample pit was sampled and analyzed for grain size distribution and permeability. The material is generally quite fine grained and has a low permeability, averaging 5×10^{-8} centimeters per second.

24. Q. Describe the plan for tailings disposal.

A. In the northeast part of the mine area only the Manuel sand is mineralized. The Manuel is separated from the Rincon by approximately 20 feet of clay. It is proposed that following the removal of the ore in the Manuel sand in the northeast area a trench be constructed inside the periphery of the pit and cut into the Rincon clay. The trench will then be backfilled with compacted overburden which will have a permeability in the range of 5×10^{-8} centimeters per second. Once the tailings have been placed in the pit, a 3-foot minimum compacted

overburden layer will be placed on top of the tailings. This method of disposal will totally encapsulate the tailings by low permeability material.

25. Q. What about tailings disposal in the other portions of the pit?

A. In the middle portion of the mine area both the Manuel and Rincon are mineralized and the intervening Rincon clay is thin. In the southwest part of the mine area the entire Rincon member is absent and the Manuel rests directly on the Catahoula.

In the middle area a method similar to that used in the northeast will be employed. After removal of the Rincon ore the trench will be cut into the Catahoula and subsequently backfilled with compacted overburden.

26. Q. Will the wall of the disposal area be lined all the way up the sides?

A. We propose that the liner be constructed only opposite those portions of the geologic section which contain predominantly sand. Three Shelby tube samples collected from the pit wall show permeabilities ranging from 3.8×10^{-7} to 5.0×10^{-9} centimeters per second for the clays and sandy clays between 32 and 48 feet from the surface, or 36 to 20 feet above the ore zone. These materials are adequate for tailings containment. In the event the tailings are placed opposite the Manuel clay the compacted sidewall will only be extended into the basal part of the Manuel clay.

27. Q. What is to be done with water which drains from the tailings while the pits are open and work is going on?

A. During the period of time the tailings are being placed in the pits, water draining from the tailings will be diverted to low areas in the pit floor and pumped back to the mill circuit. Thus, encapsulated tailings will have a moisture content less than saturation.

28. Q. What will be the effect on groundwaters following the encapsulation of the tailings?

A. Following the emplacement of the compacted overburden cap, the balance of the overburden can be placed in the pit. It is my opinion that the proposed encapsulation will prevent water which might at times percolate through the Oakville from encountering the tailings. Thus no leaching of the tailings is anticipated.

29. Q. Have you considered an alternate tailings disposal program?

A. Yes, after careful evaluation we believe the proposed method of disposal is the best method.

30. Q. Does the fault you described pose any hazard to the proposal of the company?

A. No. The major impact of the fault is as I described in my testimony relative to the occurrences of groundwater. It does have a somewhat beneficial effect, in the fact that as a result of the fault, the clays on the western

or upthrown side are relatively closer to the surface, and therefore surface operations (i.e. evaporation pond) are more secure.

31. Q. Are you familiar with comments of the Texas Department of Water Resources letter of March 28, 1980, with respect to groundwater in the vicinity of the project site?

A. Yes.

32. Q. Are you satisfied, as a result of your investigation, that the fault occurrence explains the wells completed into the Oakville on the eastern side of the mine area?

A. Yes.,

33. Q. Do you agree with the conclusions expressed in the March 28, 1980, letter that there are massive beds of clay in the upper Catahoula formation forming an aquiclude between the ore zone and the aquifers in the Catahoula below the aquiclude?

A. Yes.

34. Q. Do you also agree with the conclusion in the March 28, 1980, letter that there is no potential for vertical movement of groundwater from the ore bearing Oakville to the underlying Catahoula?

A. Yes.

35. Q. Are you also familiar with the March 28, 1980, letter of the Texas Department of Health with respect to their review of this application?

A. Yes.

36. Q. At the time the Texas Department of Health made its comments, had your report been completed and submitted to this Commission and other agencies for review?

A. No.

37. Q. Since the March 28, 1980, letter has your report been submitted to the State Health Department?

A. Yes, in connection with the application for the radioactive materials handling license.

38. Q. Do you believe that the disposal program outlined by Anaconda can be conducted without significant potential hazard to the environment or to the public?

A. Yes.

39. Q. Will any water which may come into contact with the working area of the mine be discharged or permitted to drain into any natural drainageway?

A. No. It will be used as make-up water for the mill process.

40. Q. What in your opinion will be the hydrologic consequence of mining to groundwater?

A. Because there is no groundwater and the impervious nature of the near-surface materials in the area of the mine, it is my opinion that there will be no effect on available groundwater supplies in the vicinity of the mine as a result of the operations of the company.

41. Q. In your opinion are the operations described in the permit application designed to minimize the disturbances to the prevailing hydrologic balance at the mine site and in associated off-site areas and to the quality and quantity of the water in surface and groundwater systems both during and after surface mining operations and during reclamation?

A. Yes they are.

42. Q. Are you satisfied that the collection of data, analysis, and interpretation of the data with respect to baseline water quality and the effect of operations upon water quality was done in accordance with the procedures generally accepted by persons qualified to conduct, analyze, and interpret such tests?

A. Yes. The sampling, analyses and interpretation were done either under my supervision or by consultants who are recognized experts and whose work is regularly accepted and relied upon by those responsible for preserving environmental quality during mining or construction.

43. Q. In your opinion will the post-mining land condition described in Anaconda's application pose an actual or probable threat of water diminution or pollution?

A. No it will not.

EXHIBIT A

RESUME - ED L. REED

NAME:	Ed L. Reed
EDUCATION:	B.S. in Geological Engineering, Texas Tech University.
POSITION:	President, Ed L. Reed and Associates, Inc.
EXPERIENCE:	Registered Professional Engineer in Texas. Three years Atlantic Refining Company, ten years Stanolind Oil and Gas Company, 18 years independent consulting hydrologist, 10 years Ed L. Reed and Associates.
DUTIES:	Responsible for marketing, management and engineering activities of company. Acts as consultant on many kinds of mining and subsurface solid waste disposal problems.