

Memorandum Report No. 4

WATER RESOURCES RESEARCH CENTER

2525 Correa Road
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PRELIMINARY CONSIDERATIONS
SANITARY ASPECTS OF UNDERGROUND EFFLUENT
DISPOSAL AT WAIMANALO

by

N. C. Burbank, Jr.
April 15, 1966

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It has been proposed that underground discharge of effluent from a sewage treatment plant at Waimanalo be substituted for discharge through a long and expensive ocean outfall. As a contribution to the determination of feasibility of underground discharge of the treatment plant effluent at Waimanalo, and in accordance with an agreement reached at a meeting at the Division of Water and Land Development of 16 December, the Water Resources Research Center arranged a conference on the sanitary aspects of the proposed installation. The conference was held on Thursday, February 24, 1966 at the Hawaii Institute of Geophysics Conference Room at the University of Hawaii. In attendance were the following:

D. C. Cox	U.H.	Hiroshi Okuda	C.C.H.
N. C. Burbank, Jr.	U.H.	Chew Lun Lau	C.C.H.
James Yoshimoto	DOWALD	E. H. Broadbent	TOWILL
A. Q. Y. Tom	U.H.	B. J. McMorrow	S.H.D.
Francis Aona	C.C.H.	Francis Woo	S.H.D.
Shinji Soneda	C.C.H.	James Nakahara	S.H.D.
Albert Tsuji	C.C.H.		

In summary this memorandum includes the discussion of the salient features under consideration.

Three items of major consideration in the proposed Waimanalo Effluent Disposal project were indicated. These were (1) a program to characterize the sewage, (2) consideration of the offshore monitoring program and (3) future studies required.

CHARACTERIZATION OF SEWAGE

Burbank outlined the regulations in 40 states concerned with deep well injection of wastes. Primary concern was always in the protection of existing ground water resources. The state of Texas has the most stringent regulations and looks upon such injection as permanent storage.

Three major factors govern waste disposal by injection, these are the suitability of a site, the suitability of the waste, and the economics of the project.

In this particular discussion it appears that suitability of the waste is of primary concern.

Previous work in deep well injection have indicated that Darcy's Law of flow of fluids through porous media applies except for clogging effects. The quality of effluent is of major concern in the control of clogging.

Most injection has been into previous limestone or sandstone formations. In such low porosity rock the major considerations were non-clogging characteristics of the waste along with control of corrosion. Certain major items of concern in clogging of fine formations were suspended solids, fats and greases, bacteria, algae and molds. For structures with small pores the basic requirements were Suspended Solids 0, Iron and Manganese 0, pH 8.2, Fats and Grease 0, Dissolved Oxygen 0, Bacteria, Molds, Fungi and Algae controlled by a bactericide compatible with diluent, the absence of ions likely to cause precipitation at the interface of the waste and the aquifer's natural water. These were recommendations of Lawrence Cecil based on injection of salt brines in the oil fields.

The U. S. Public Health Service Advanced Waste Treatment Study Group adds the prohibition of any materials which will precipitate with ORP changes and any materials which form resin-like polymers.

The experience of Florida in the discharge of raw sewage into underground formations was described.

The proposed quality of sewage effluent from the planned plant was discussed. The plant is to be activated sludge type utilizing block aeration, with both primary and secondary treatment. A reserve lagoon should be provided for emergency tertiary treatment.

The effluent is expected to have suspended solids less than 50 mg/l, Fats and Oils - 0, phosphates 1-7 mg/l, pH 6.8 - 7.2, Dissolved oxygen 1-3 mg/l, Chlorinated to destroy bacterial growth, Iron as low as carriage water - normally considered as absent.

It was pointed out that the major unanswered property of such a disposal project was the porosity of the formation. If the formation proves to have a high porosity, if the porosity is sufficiently coarse, and if there is good permeability the sewage treatment plant effluent may be entirely acceptable and may not cause clogging of the formation.

Permeability and porosity should be measured as the exploratory wells are drilled to determine the optimum stratum for acceptance of waste.

There was agreement that background information was needed particularly in respect to the characteristics of the water in the strata in the Waimanalo area.

Further chemical and physical characteristics and the quality of the water in the hole should be determined to ascertain its true characteristics and quality before waste discharge.

Records of the sewage treatment plant at Wahiawa are available for general overall indications of the waste characteristics.

The possibility of advance testing of new drill holes using the temporary existing treatment plant at Waimanalo was explored.

The matter of effluent quality and necessary polish in the proposed lagoon was discussed. The lagoon is to serve as a standby reserve for emergency tertiary treatment and an acceptable effluent receiving area until the disposal well proves satisfactory or an outfall is built.

The necessity of an operating agreement between the State as owner and the City as operator of the proposed plant was raised. The City feel the State should retain title and responsibility for the construction of all plant features including the disposal well until the method of disposing the effluent through wells has proven to be successful and acceptable to the State Health Department or the ocean outfall is constructed. The necessity of establishment of criteria for the determination of success or failure for the well disposal was discussed.

OFFSHORE MONITORING PROGRAM

James Nakahara presented the Hawaii State Department of Health's present offshore monitoring program.

There are three established sites of record on the Kailua side of Waimanalo. These are sampled once each month. The index of quality is the Coliform index and the total plate count.

Summary of the bacteriological analysis of the last 12 samples from each of the three established stations for the Waimanalo shore water monitoring program is as follows:

1. The average coliform index was 14.
2. Approximately 92 percent of the samples met the Department of Health's standard for public natural bathing places.
3. Approximately 61 percent of the samples indicated coliform index of less than 50 to qualify for Class A.
4. Approximately 33 1/3 percent of the samples were reported as being negative for coliform bacteria.
5. The average standard plate count was reported as 143 per milliliter.

It was suggested that during the coming months the State Health Department sampling crew should take offshore samples in a grid pattern. It was suggested that the presence of Enterococci be checked and a bottom organism survey be made as well.

The University of Hawaii's Marine Biological Group would be requested to make the benthic survey.

In connection with the offshore monitoring program it was suggested that sampling in depth should be performed on the test holes and their contents. A baseline of values especially for orthophosphates and nitrates should be in order.

FUTURE STUDIES

From the conference it was concluded that:

(1) Porosity and permeability studies must be made upon the drilled wells as they are in progress. The porosity and permeability of the stratum to be used for underground disposal is the critical item in this study.

(2) Effluent quality of the treated sewage is available from the records of the Wahiawa Treatment plant. Further analysis of quality will be made as the drilling progresses. Samples of water from the aquifer would be collected from the well as drilling progresses by DOWALD; these samples should be checked by a competent research laboratory for compatibility with the waste.

(3) A baseline of analysis in the monitoring program must be established. The State Health Department will make its normal baseline study. A grid sampling survey will be made offshore by the State Health Department.

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