

Due to the following Causes.—Horahora: Fire in transformer-house, 1st September. Failure of condenser-bushings on Waikino line O.C.B., 17th and 21st February.

Waihou: Blowing of 50 kv. transformer-fuses on 3rd, 4th, and 5th February, for no apparent reason, interrupted supply at this substation.

Waikino: Breakdown of wall-entrance bushing. Three short-circuits of 11 kv. gear were caused by rats.

Kerepeehi: Breakdown of bushing in a transformer 11 kv. trifurcating-box.

Bombay: Failure of 50 kv. insulator on an air-break switch.

Penrose: Flash-over on an 11 kv. fuse. Damage to a trifurcating-box caused by rain through a broken window. A 6,600-volt bushing on the main transformers failed and was replaced.

Henderson: A rat caused a short-circuit on an 11 kv. potential-transformer.

Hamilton: Flash-over on 11 kv. insulators on the take-off structure during a storm.

Hangatiki: Breakdown of current-transformer in the ironclad switch-gear, and damage to leads in main transformers.

Mamaku: Breakdown of 150 kv.a., 50 kv. transformer.

Edgecumbe: Flash-over on 50 kv. lightning-arresters. Flash-over between 11 kv. fuses on earthing-reactor. Failure of bushing on 11 kv. trifurcating-box.

No trouble occurred at Takapuna, Te Awamutu, Arapuni, and Ngongotaha Substations.

General.

The Okere plant has been run regularly throughout the year from 6 a.m. to 10 p.m. on six days per week, by arrangement with the Tourist Department.

While generally successful, the operation of four plants—Horahora, McLaren's, Grand Junction, and the Diesel plant—in parallel over fairly long lengths of line with each other and with King's Wharf has proved fairly difficult.

The 50 kv. system consists of over 400 miles of line, and under the present temporary means of supplying it all from Horahora it has not been practicable to install the gear necessary to cut out a defective section without interruption to the rest of the system. It is probable, too, that on such an extensive system, supplied by comparatively small stations, a fault that is of little importance in itself may cause disturbance in voltage sufficient to cause trouble on some part of the system. Some of the interruptions during the year may be due to that reason. Further, with all plants fully loaded, an interruption which cut off one of them would generally lead to an interruption on all of them, though not in all cases, and the time required to restore service has been increased by the necessity for telephoning instructions *re* synchronizing, &c., before load could be put on. The bulk of this work has fallen on the operating staff at Horahora, who are entitled to credit for the way in which they have carried it out, as are also the operating staff at Penrose, Waikino, the Grand Junction plant, and Hamilton.

Operation of Arapuni (June and July, 1929).—No. 3 unit at Arapuni was first started on 4th May, 1929. Drying-out on short circuit was completed on 31st May, and after relay tests and preliminary governor tests it was run in parallel with King's Wharf for short periods on the 2nd and 3rd June, and regularly from the 4th June—at first from about 3 p.m. to 9 a.m., and then continuously, carrying occasionally up to full load.

On the 7th July Arapuni took over the following load—Penrose Area and southern area of Auckland Power Board, Takapuna Substation, Henderson Substation, Bombay Substation, Hamilton Substation, Kerepeehi Substation—and gave supply to it continuously. The Arapuni maximum load was then little over 15,000 kw., with daily output about 250,000 units.

Horahora, with the occasional aid of McLaren's and the Junction plant, then supplied the rest of the Waikato system—total load, about 9,500 kw.—and the two plants were not in parallel with each other or with King's Wharf.

I regret to have to record the death on the 4th May of Mr. J. W. Swaney, Power-station Superintendent in charge of Arapuni and Horahora. Mr. Swaney had been in charge of Horahora since 1925, and it is due mainly to his energy and ability that the power-station has been satisfactorily maintained during this difficult period. His place at Arapuni has been filled by Mr. W. H. G. Watson, First Operator at Lake Coleridge.

ARAPUNI.

Construction.

In connection with the civil construction work during the year see Engineer-in-Chief's report.

Design Work.

Consequent upon the Department taking over from Messrs. Armstrong, Whitworth, and Co., the preparation of new designs for the power-house foundations to take up the ground-stresses as found was undertaken by the electrical design office, and detail constructional drawings issued for same. Numerous structural drawings were also prepared for modifications found necessary in connection with other features in the contractor's original designs.

Generators.

During the year the assembly and erection of No. 3 generator, 17,650 kv.a. (15,000 kw.), was put in hand as soon as the power-house building was sufficiently advanced to provide cover, and by the 4th June, 1929, this machine was completed and placed in service. Good progress is being made with