

**UNEP/UNESCO/UNCHS/ECA**

**URBAN POLLUTION OF SURFICIAL AND GROUNDWATER  
AQUIFERS VULNERABILITY IN WESTERN AFRICA**

**EARLY WARNING BULLETIN - NIAMEY AQUIFERS**

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**National Coordinator of the Project**

## **SUMMARY**

- I Identification of the Pollution Monitoring Stations of the Niamey Aquifer
- II Tables and Diagrams/Graphs of Physico-chemical and Piezometric Data
- III Tables of Specific Chemical Data
- IV Tables and Diagrams/Graphs of the Bacteriological Contents of the Aquifer
- V Situation and Development of the Chemical and Bacteriological Pollution of the Aquifer

## I Identification of the Pollution Monitoring Stations of the Niamey Aquifer

Six monitoring stations have been selected and distributed in the 4 survey sites of the project as follows:

- P-101 in the downstream zone (Goudel-Bas district)
- P-204 in the downstream zone II (Gnalga)
- P-306, P-331 and P-333 in the zone III (P-306 in the Saga Gardens; P-331 and P-333 in Pays Bas)
- P - 401 in the zone IV (DAN – GAO district)

NB: The over-pumping of the 5-catchment points has been a determinant factor for the selection of the monitoring stations. As for the well P-333, its selection is due to its installation on a dumping ground.

## II Tables and Diagrams/Graphs of Physico-chemical and Piezometric Data

The water is relatively mineralized with a conductivity fluctuating between 800 and 4300  $\bullet$  s.cm<sup>-1</sup> except the station P-331 where the conductivity is 200  $\bullet$  s.cm<sup>-1</sup>. The conductivity fluctuations depend on the catchment points with an increasing trend in proportion to the decrease of the Piezometric level (see-tables and graphs).

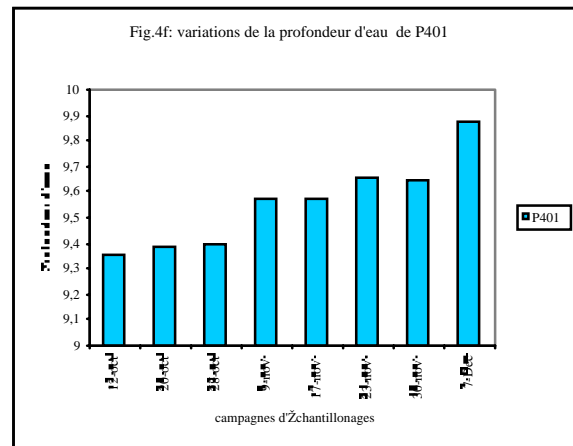
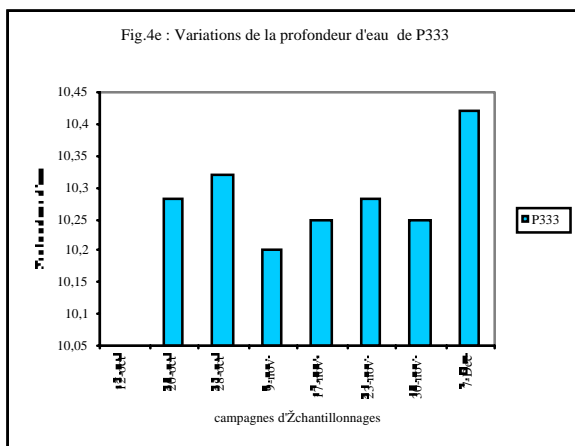
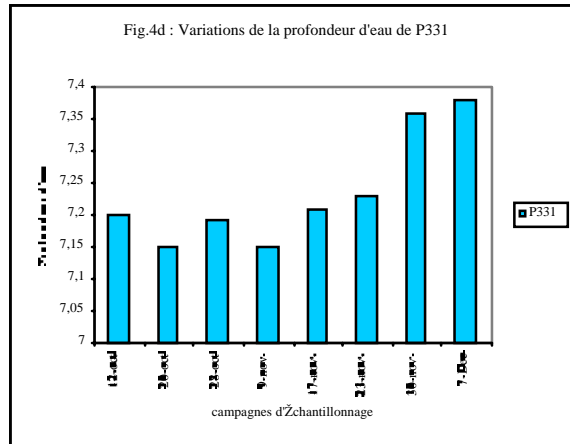
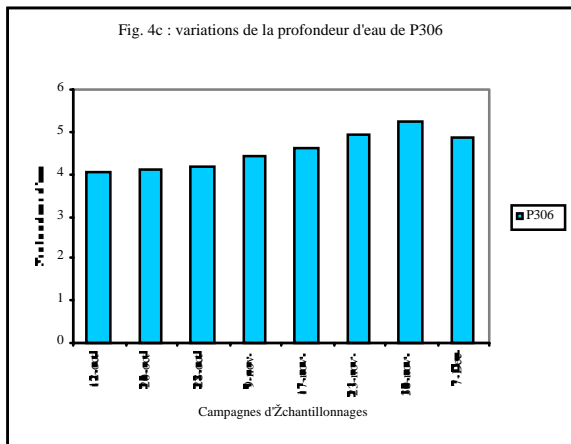
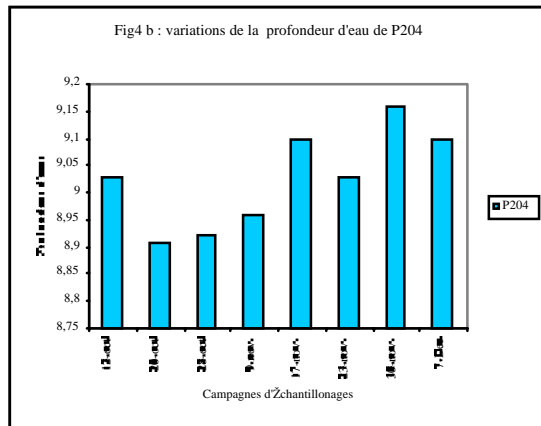
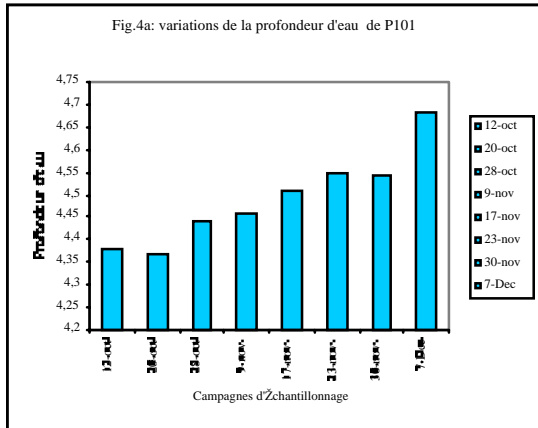
	Weekly sampling dairy			12/10/2001 (1 <sup>st</sup> Samplings)				20/10/2001 (2 <sup>nd</sup> Samplings)			
	X	Y	Z	T°C	CE	PH	Piezo	T°C	CE	PH	Piezo
<b>P101</b>	2,0576	13,5240	185,37	30,2	1330	7,6	4,38	29,3	1350	7,66	4,37
<b>P204</b>	2,1115	13,4841	186,76	32,2	1036	7,86	9,03	32,4	1048	7,92	8,91
<b>P306</b>	2,1461	13,4684	184,67	30,1	1768	7,98	4,06	30,1	1952	7,73	4,11
<b>P331</b>	2,1446	13,4849	198,83	31	217	8,5	7,2	30,6	216	7,82	7,15
<b>P333</b>	2,1483	13,4838	204,49					32,1	6370	8,04	10,28
<b>P401</b>	2,1426	13,5210	218,53	30,9	809	7,75	9,35	30,8	801	7,7	9,39

	X	Y	Z	28/10/2001 (3rd Samplings)				9/11/2001 (4 <sup>th</sup> Sampling)			
				T°C	CE	PH	Piezo	T°C	CE	PH	Piezo
<b>P101</b>	2,0576	13,5240	185,37	28,3	1382	7,74	4,44	29,4	1377	7,66	4,46
<b>P204</b>	2,1115	13,4841	186,76	30,7	1070	7,6	8,92	31,5	1055	8,07	8,96
<b>P306</b>	2,1461	13,4684	184,67	29,3	2200	7,52	4,16	30	3520	7,8	4,39
<b>P331</b>	2,1446	13,4849	198,83	29,9	210	7,55	7,19	30,3	211	7,98	7,15
<b>P333</b>	2,1483	13,4838	204,49	31,1	4870	8,04	10,32	31,6	2450	7,88	10,2
<b>P401</b>	2,1426	13,5210	218,53	30,7	804	7,06	9,4	30,7	825	7,14	9,57

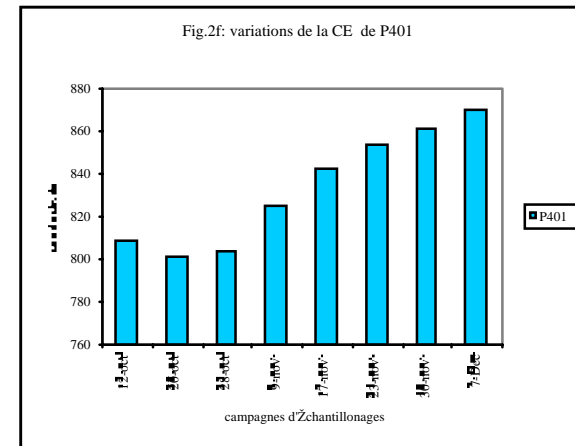
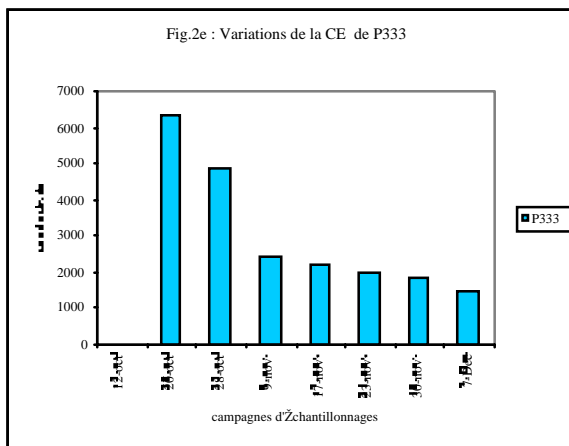
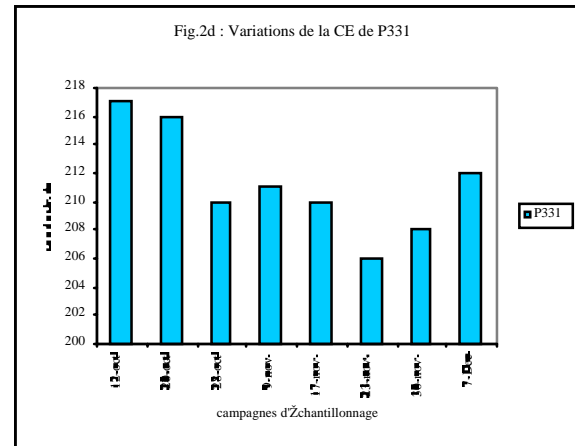
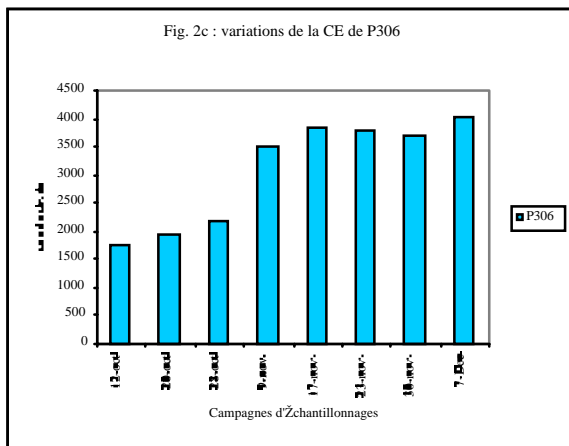
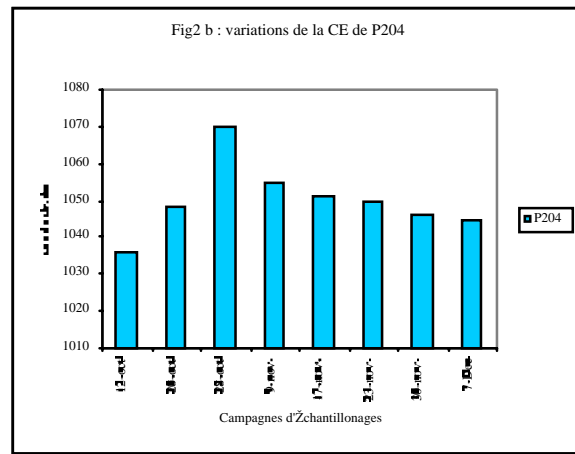
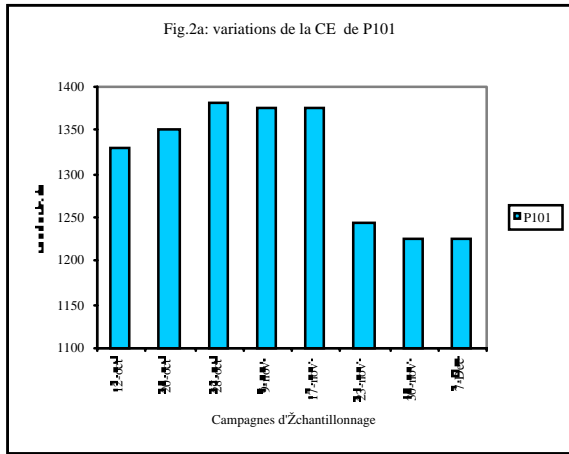
Weekly Sampling dairy	X	Y	Z	17/11/2001( 5th Samplings)				23/11/2001 (6 <sup>th</sup> Sampling)			
				T°C	CE	PH	Piezo	T°C	CE	PH	Piezo
<b>P101</b>	2,0576	13,5240	185,37	28,2	1375	7,92	4,51	28,2	1245	7,65	4,55
<b>P204</b>	2,1115	13,4841	186,76	31,1	1051	7,77	9,1	30,7	1050	7,93	9,03
<b>P306</b>	2,1461	13,4684	184,67	30,7	3850	7,38	4,6	30,1	3780	7,16	4,94
<b>P331</b>	2,1446	13,4849	198,83	30,1	210	7,7	7,21	29,6	206	7,35	7,23
<b>P333</b>	2,1483	13,4838	204,49	31,6	2220	7,52	10,25	30,5	1996	7,65	10,28
<b>P401</b>	2,1426	13,5210	218,53	30,7	843	6,6	9,57	30,1	854	6,83	9,66

	X	Y	Z	30/11/2001(7th Samplings)				7/12/2001(8 <sup>th</sup> Samplings)			
				T°C	CE	PH	Piezo	T°C	CE	PH	Piezo
<b>P101</b>	2,0576	13,5240	185,37	28,1	1226	7,53	4,54	26,3	1225	7,98	4,68
<b>P204</b>	2,1115	13,4841	186,76	31,5	1046	7,78	9,16	29,1	1045	7,8	9,1
<b>P306</b>	2,1461	13,4684	184,67	30,6	3700	7,05	5,27	27,7	4030	7,5	4,86
<b>P331</b>	2,1446	13,4849	198,83	29,7	208	6,9	7,36	28,1	212	7,94	7,38
<b>P333</b>	2,1483	13,4838	204,49	31,1	1851	7,35	10,25	29,3	1452	7,7	10,42
<b>P401</b>	2,1426	13,5210	218,53	30,2	861	6,13	9,65	29,7	870	7,06	9,87

## Water level variations Histograms



## Conductivity variations Histograms



### III Table and graphs of chemical and physical data variations

The nitrate contents of the wells P-101, P-204, P-401 significantly exceeds the standard of 50 mg/l agreed by the World Health Organization (WHO).

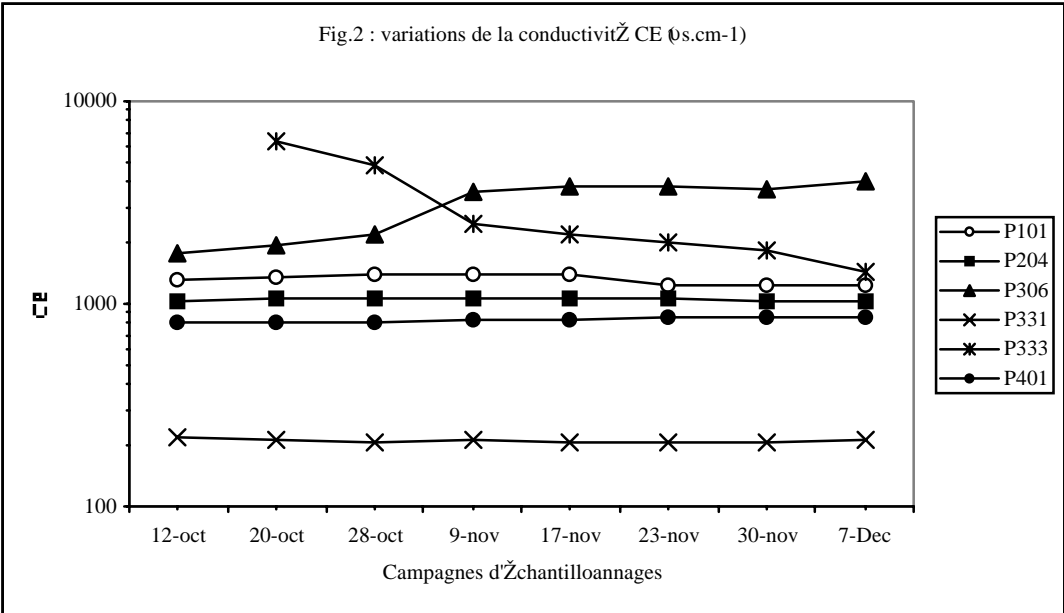
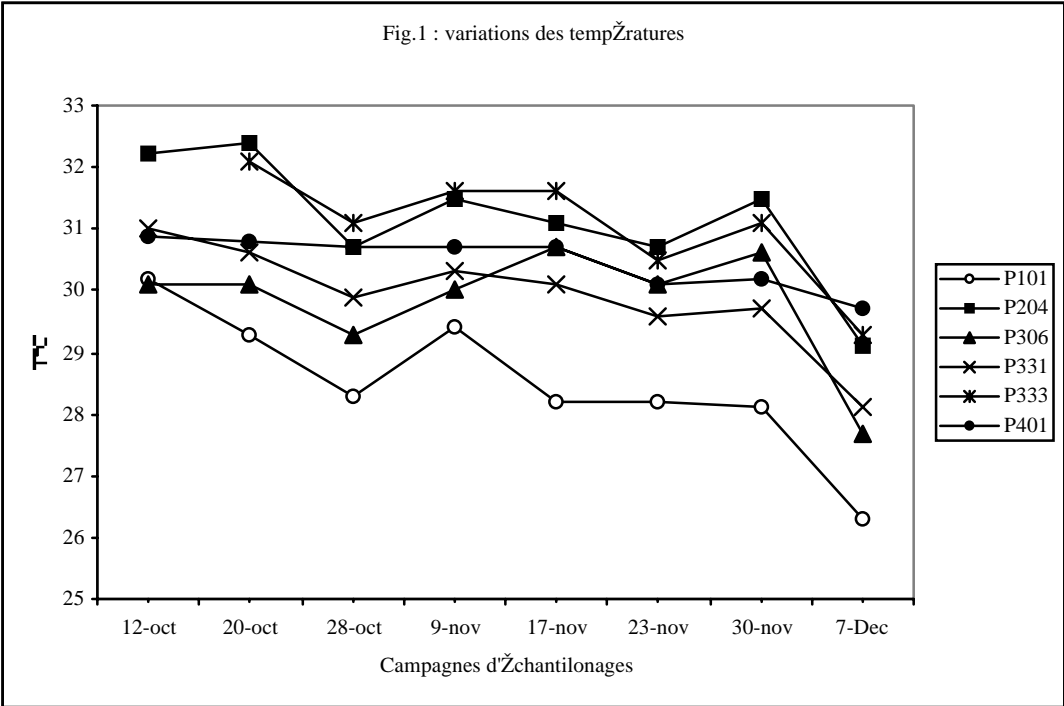
An increase of the nitrate concentration has been recorded during the pumping operation (P - 204 - I at the beginning of the pumping operation and P - 204 - II at the end of the pumping operation; P- 401 - I at the beginning of the pumping operation and P - 401 - II at the end of the pumping operation).

A decrease of nitrate contents has been noted in the Well P-306. These outcomes indicate that the water of the wells concerned is polluted. Moreover, high nitrate concentrations were recorded in the well P - 306, which suggest that the well is quite sulphate-polluted. Finally, the chloride contents were significant in the waters containing high concentrations of nitrates and sulphates.

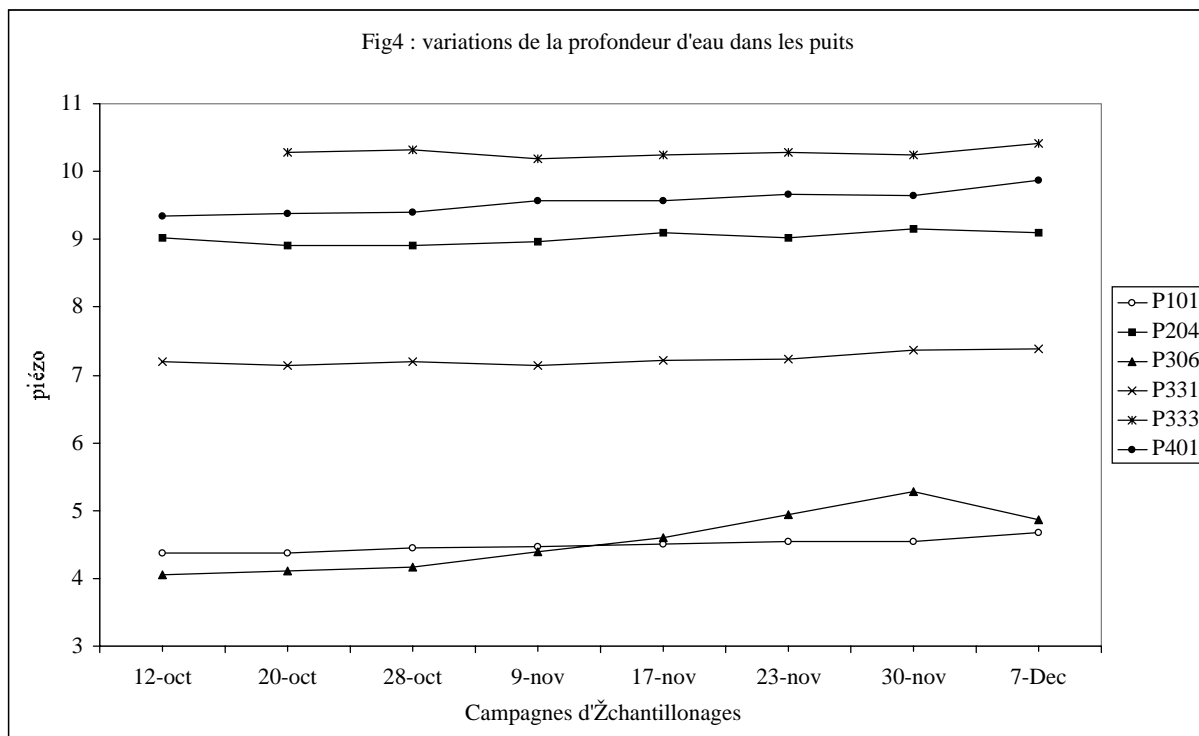
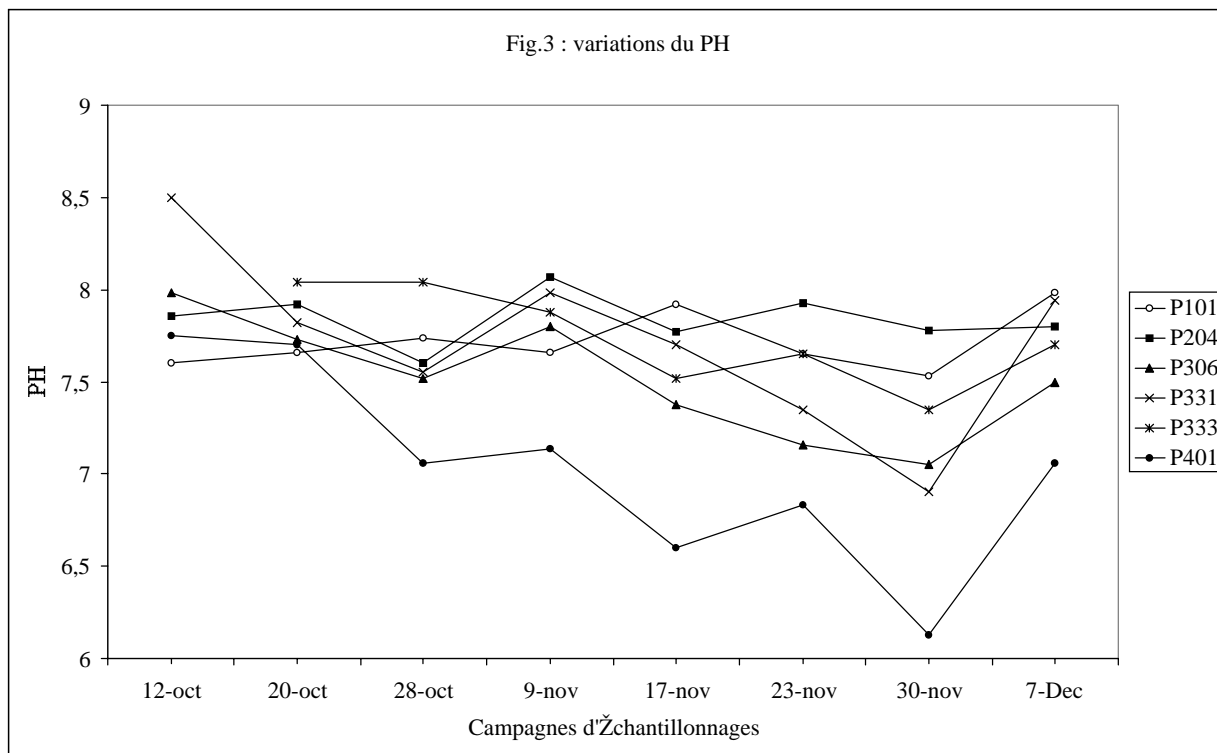
POINT D'EAU	PH	1/r ms.cm -1	Ca++	Mg++	Cl-	SO4--	HCO3-	NO3-	NO2-
P101 I	7,3	995	75	47,5	92	55	226	<b>105,5</b>	0,01
P204 I	7,4	979	90,4	25	58,5	60	256	<b>99</b>	0,02
P204 II	7,2	986	76	28,5	58,3	65	293	<b>110</b>	0,02
P306 I	7,8	1292	68	63,5	110	250	366	44	0,01
P306 II	7,8	1297	67	63	105,5	245	366	17	0,01
P331 I	6,3	216	13,5	5	9	17	36,5	22	0,02
P331 II	5,9	200	11	5,5	7,5	26	43	22	0,01
P401 I	5,2	843	41	16	69	traces	traces	<b>242</b>	0,13
P401 II	4,5	870	39	17,5	71	traces	traces	<b>264</b>	0,07
P333					40	traces	traces	4	traces

Table I: Chemical components of the underground waters of the 6 selected wells

**Physico-Chemical Data (Temperature, pH & conductivity) Variations Graphs and Water levels of the Six Monitoring Wells**







#### IV Tables and Diagrams/Graphs of the Bacteriological Contents of the Aquifers.

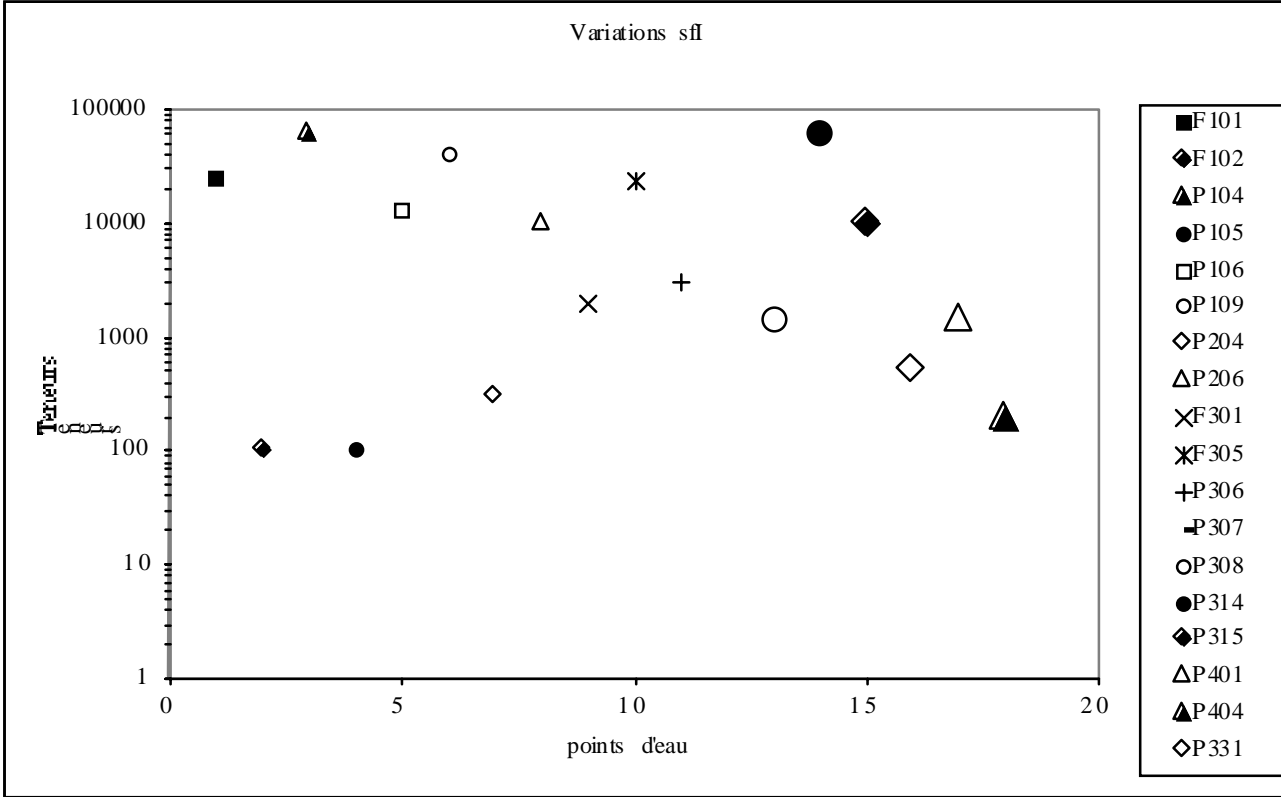
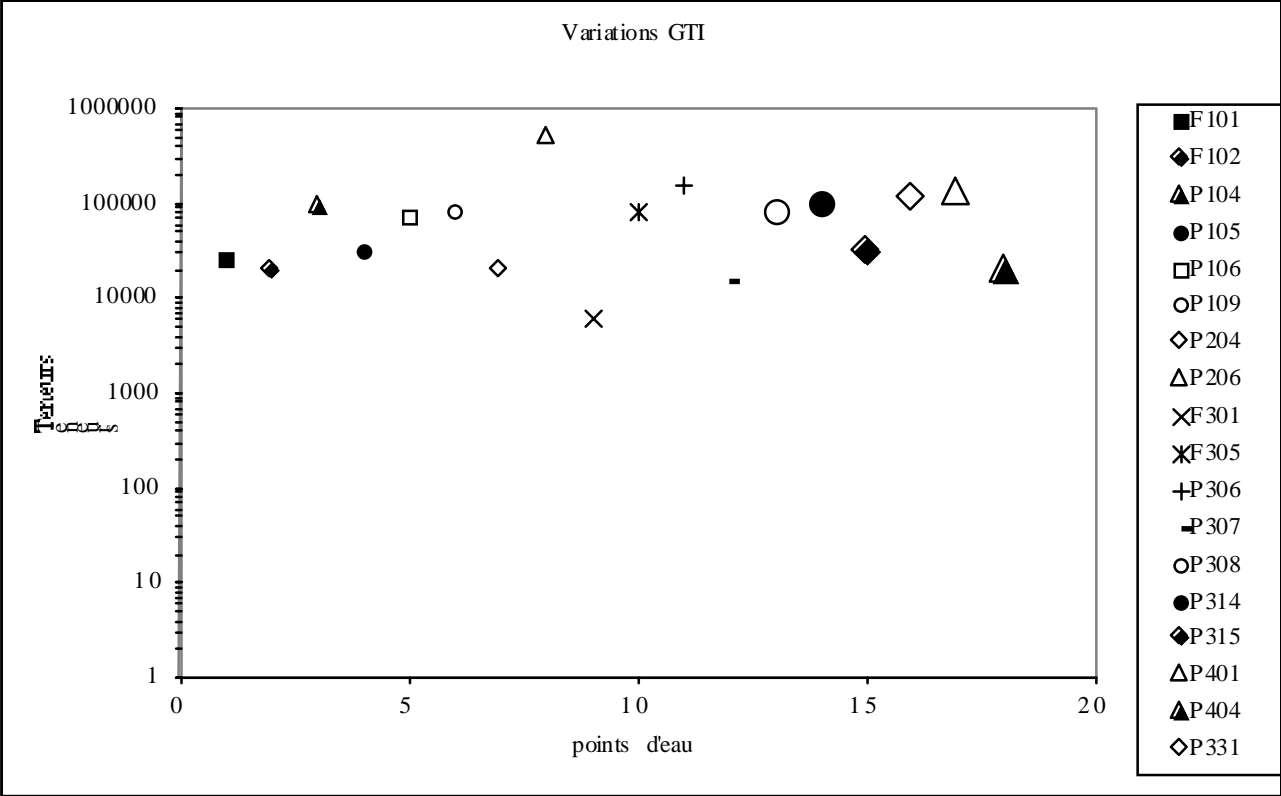
The bacteriological analysis of the waters (see - tables and graphs/diagrams) indicate an almost inclusive pollution for all the selected monitoring stations including the wells P-204, P-306, P-331 and P-401. Furthermore, the well P-331 whose conductivity value and nitrate contents were far below the standard agreed by the World Health Organization (WHO) was identified as bacteriologically polluted.

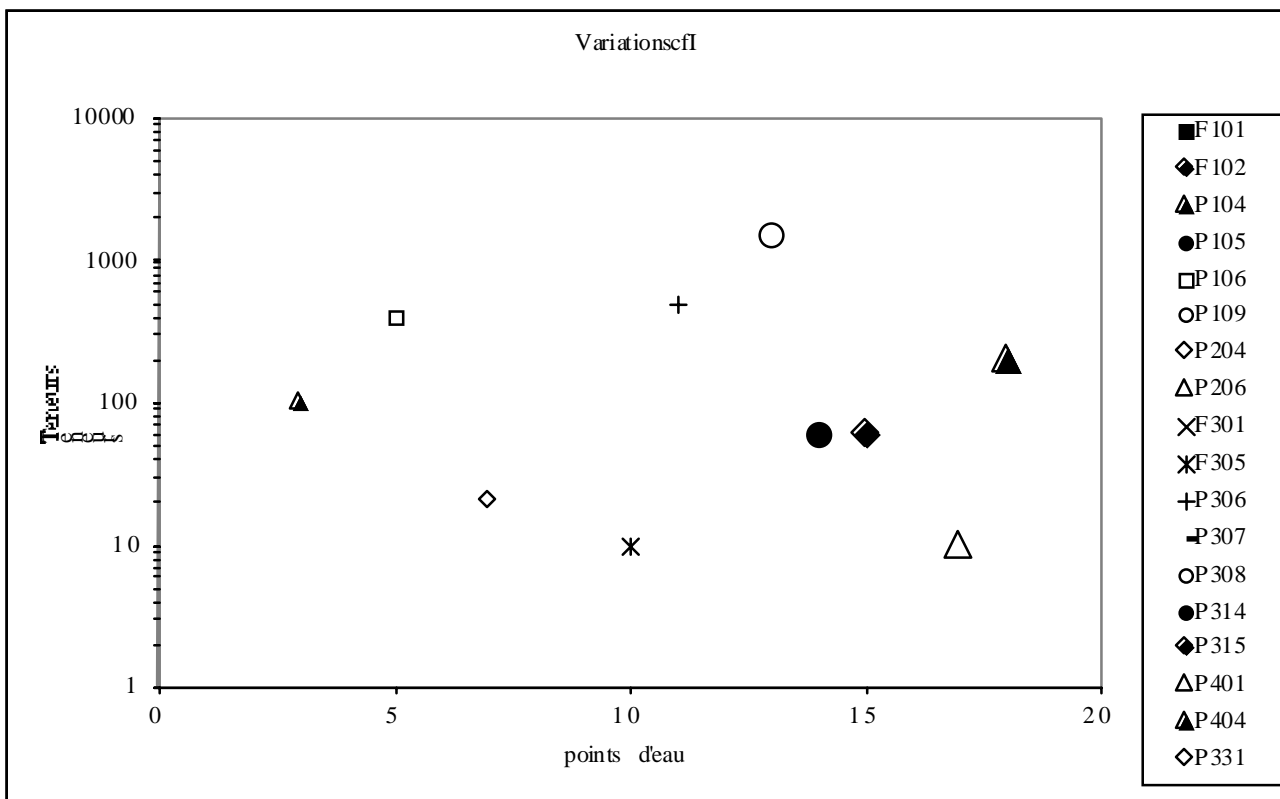
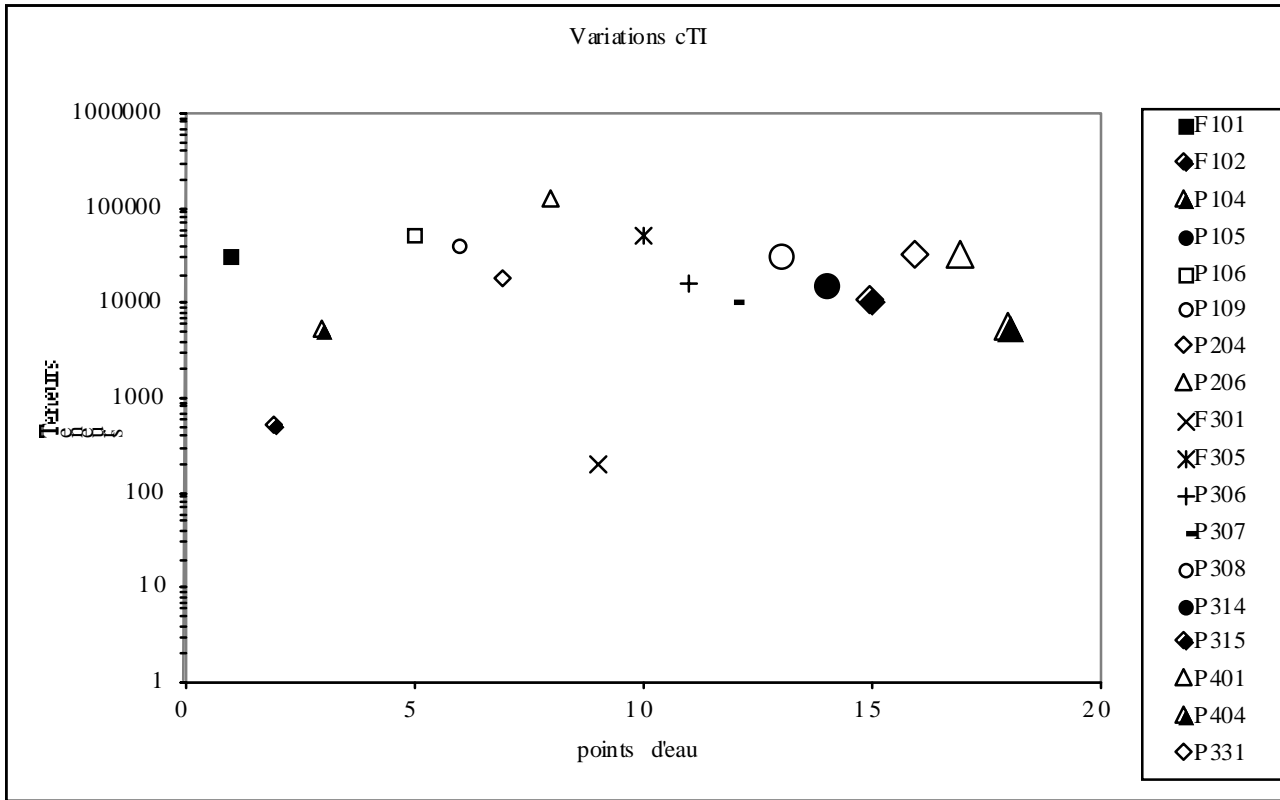
NB: The bacteriological survey is still in process and the high fluctuations recorded in some results require further analysis before their dissemination.

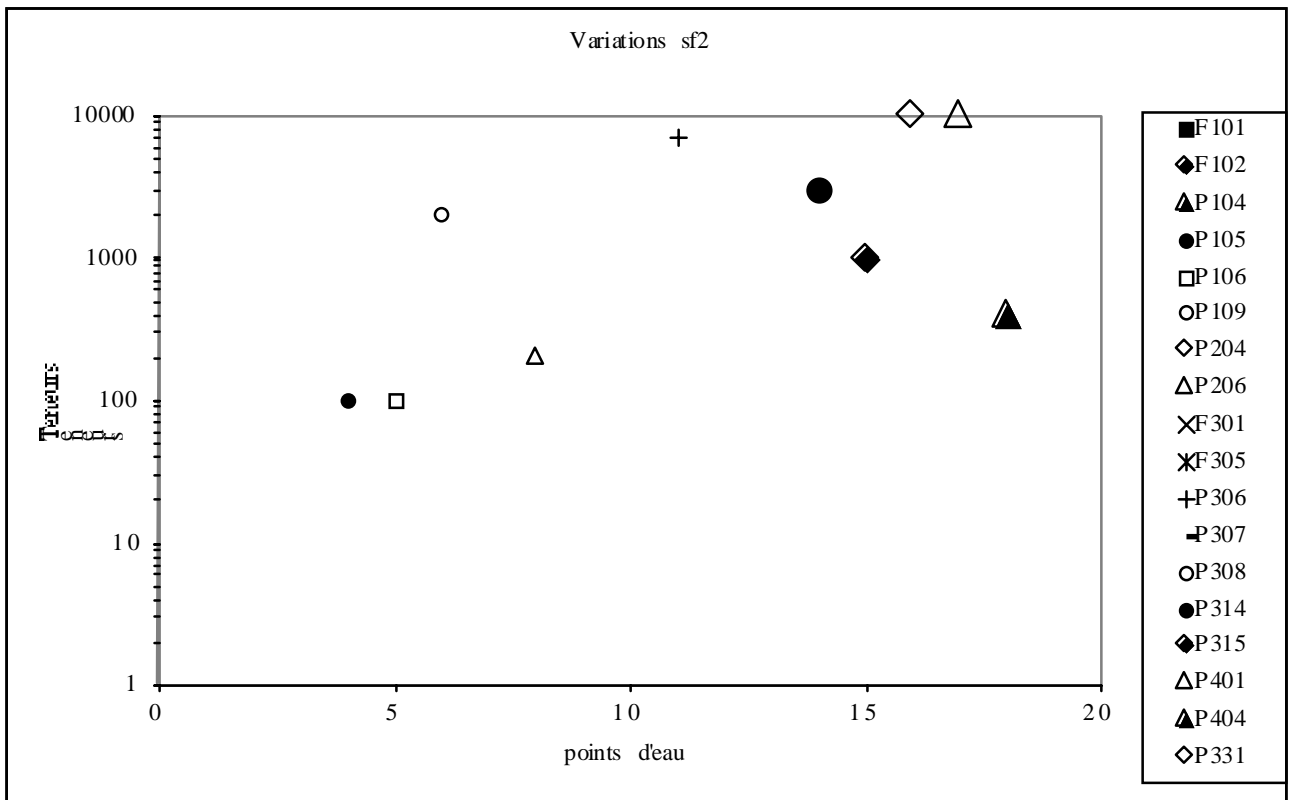
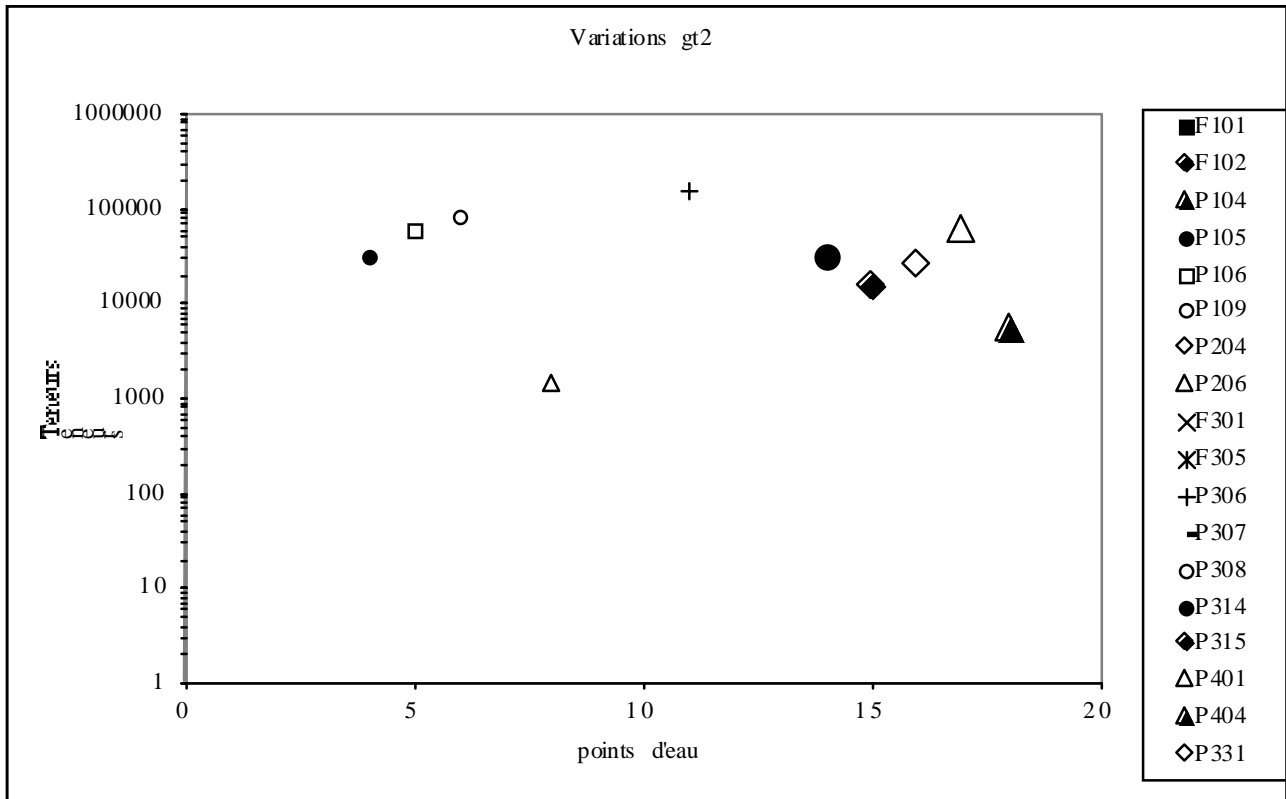
well	Date	August 2001 Samplings							
		GTI (UFC/100ml)	SFI (UFC/100ml)	CTI (UFC/100ml)	CFI (UFC/100ml)	GTH (UFC/100ml)	SFH (UFC/100ml)	CTH (UFC/100ml)	CFH (UFC/100ml)
F101	27/09/01	60000	25000	30000	0	-	-	-	-
F102	27/09/01	20000	100	500	0	-	-	-	-
P104	28/09/01	90000	60000	5000	100	-	-	-	-
P105	27/09/01	30000	100	0	0	30000	100	0	0
P106	28/09/01	70000	13000	50000	400	60000	100	40000	200
P109	28/09/01	80000	40000	40000	0	80000	2000	40000	0
P204	24/09/01	20000	300	17000	20	-	-	-	-
P206	24/09/01	500000	10000	120000	0	1400	200	200	0
F301	26/09/01	6000	2000	200	0	-	-	-	-
F305	28/09/01	80000	23000	50000	10	-	-	-	-
P306	22/09/01	150000	3000	16000	500	150000	7000	70000	100
P307	22/09/01	15000	0	10000	0	-	-	-	-
P308	21/09/01	80000	1400	30000	1500	-	-	-	-
P314	21/09/01	100000	60000	15000	60	30000	3000	20000	300
P315	28/09/01	30000	10000	10000	60	15000	1000	7000	200
P331	22/09/01	110000	500	30000	0	25000	10000	10000	10
P401	27/09/01	130000	1400	30000	10	60000	10000	40000	60
P404	24/09/01	19000	200	5200	200	5500	400	3500	10

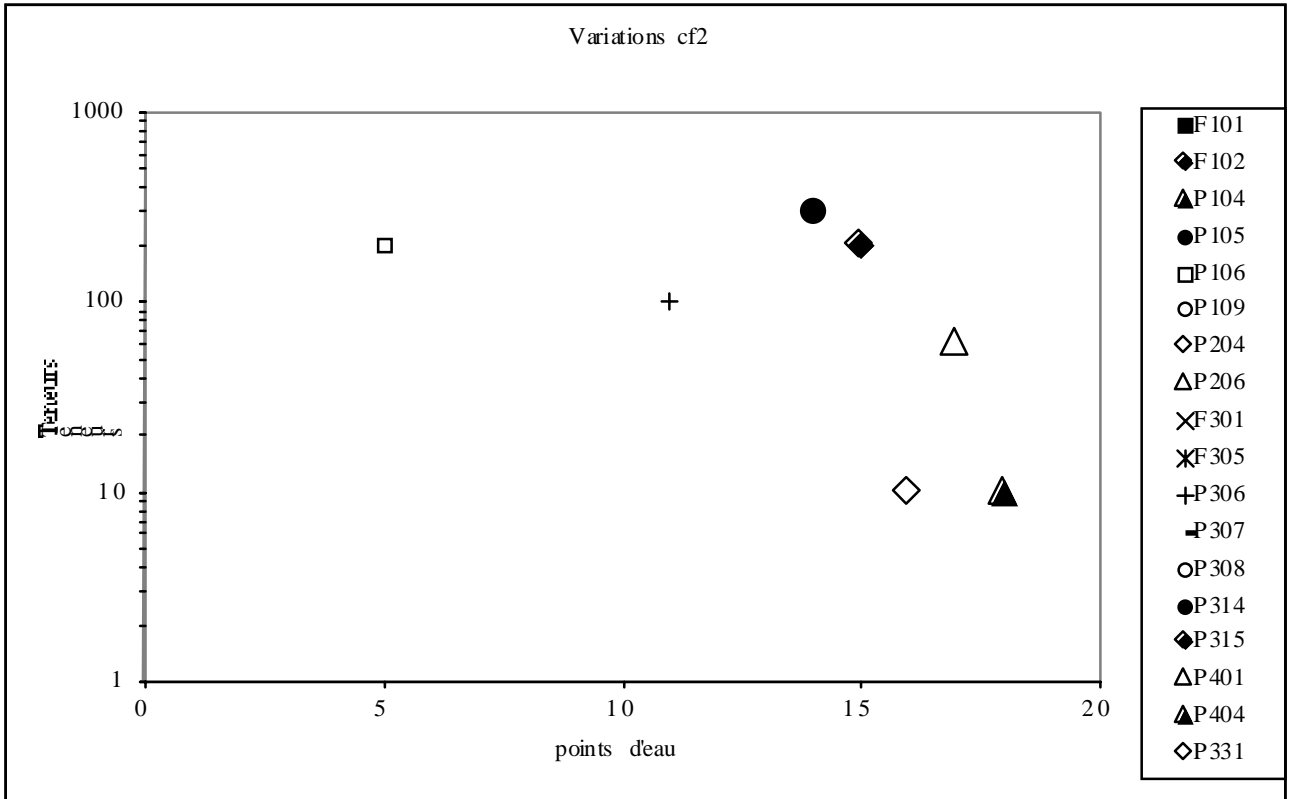
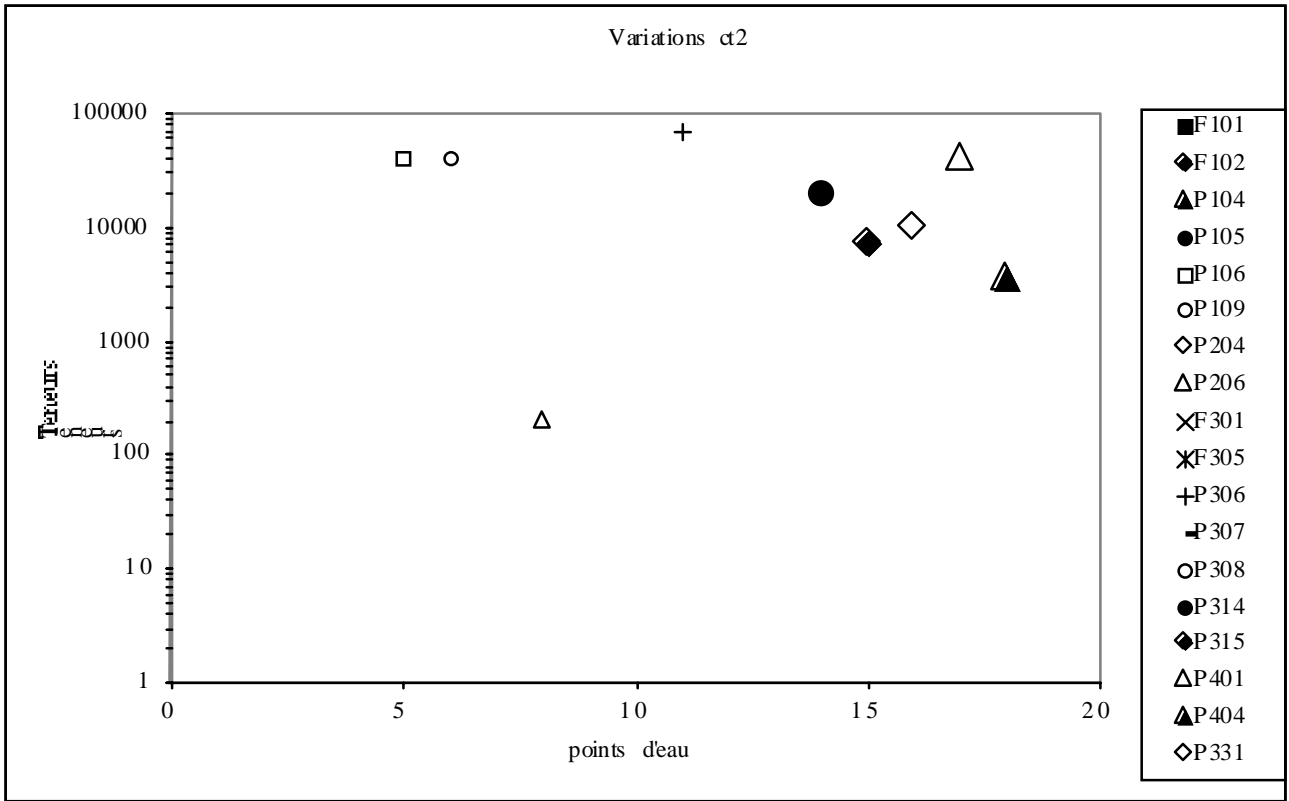
Table 2: Bacteriological concentrations of the various Aquifers

SF = Sulfates  
 GT = Total germs  
 CF = fecal coli forms  
 Total coliforms









## **V Situation and Development of the Chemical and Bacteriological Pollution of the Aquifer.**

The chemical and bacteriological data indicated either a chemical and bacteriological pollution or a bacteriological pollution only for all the waters of the various aquifers (basement aquifers, Continental Terminal aquifers and alluvial aquifers in Niamey Urban Community (former reports).

The pollution tends to develop along with the increase of the uncontrolled disposal sites, the wastewater discharges, the improperly drained rains waters.

With regard to the relatively significant use of the wells, mainly in the outskirts of Niamey City, for drinking water supply, it is urgent to undertake their bacteriological treatment.