



## Application: Tap Changer

ISOPur Fluid Technologies eliminates carbon buildup in transformer oil and greatly reduces oil turn-over, saving the company man-hours and money

### Introduction

Consolidated Edison Company of New York (Con Edison), a regulated utility, provides electric service in New York City and most of Westchester County. The substation, located on Staten Island, NY, is one of the largest custom power factor correction stations in the world.

When the tap changers were opened for servicing, there was visible evidence of a significant reduction of carbon buildup on the insulators and more importantly on the contact points (see Figures 1 & 2).

### The Challenge

Con Edison was experiencing carbon buildup on the glass insulators as well as destruction of the copper contacts in two of their tap changers. The contamination caused arcing and reduced dielectric KV levels, creating an unstable environment within the fluid. As the transformer oil became heavily contaminated, the insulation was reduced causing erosive wear and dangerous short circuiting.

Extremely contaminated fluid, if left untreated, increases the potential for volatile conditions. Previous efforts to control contamination included a station shut down every three months for draining, cleaning, and servicing of transformers.

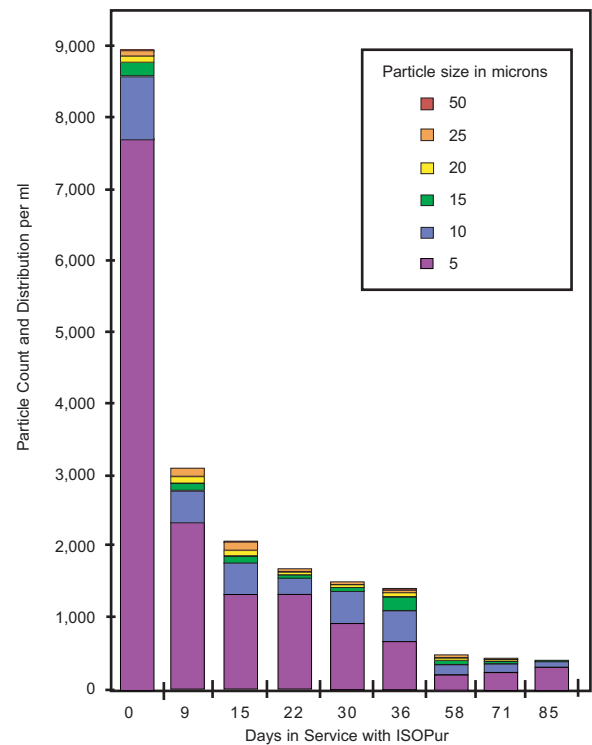
The use of fine filtration (3-5 microns) would not have eliminated the carbon contamination because the average size of carbon particles are generally in the 0.1 to 0.5 micron range and are much too small to be collected by filters.

Con Edison had previous experience using ISOPur's Balanced Charge Purification (BCP) technology. Graph 1 shows the results of an oil analysis test conducted in the 1990's.

### The Solution

More recently, in July 2003, ISOPur installed two purification systems in a kidney loop on each of two dedicated 2000 gallon fluid reservoirs. Immediately following start-up of the IOSPur systems there was a positive effect not only on the carbon contamination but the entire transformer oil system.

Graph 1: Original Transformer Oil Analysis



Gas-in-oil Analysis - Days in Service vs. Gas Type

	0	9	15	22	30	36	58	71	85
Hydrogen:	0.1	20	32	49	69	78	105	171	0.5
Oxygen:	22,300	26,000	28,100	11,400	26,200	10,400	22,100	26,500	12,000
Nitrogen:	44,100	56,400	60,800	25,500	56,400	23,200	41,700	60,600	27,800
Methane:	0.1	3	7	8	22	21	44	78	39
Carb.Monoxide:	0.1	0.1	2	21	63	74	96	230	94
Carb. Dioxide:	208	91	81	181	55	77	80	86	86
Ethane:	0.1	0.1	1	0.1	3	2	7	13	6
Ethylene:	1	10	14	12	41	31	90	158	84
Acetylene:	8	44	56	42	114	79	248	398	244
T.C.G.	9	77	112	131	312	285	590	1,048	467

All figures are parts per million - 0.1 = < 0.5 ppm or non detectable  
T.C.G. = Total Combustible Gases

Figure 1 is the tap changer before the Balanced Charge Purification (BCP) technology was implemented. Note the carbon and sludge found on the base and on the screw plate contact points.

Figure 2 is the tap changer after 10 months of continual oil purification with the ISOPur system. Note the clean appearance and removal of carbon contamination. Sludge has also been removed from the contact points, leaving them scoured and shiny.

Graph 2 shows the positive effect on the carbon contamination as well as on the entire transformer oil system. In addition, the physical condition of the fluid has improved after less than a year of purification. Oil samples were taken at installation and then again 10 months later.

**The Return**

Prior to the ISOPur installation, the tap changers were drained, cleaned, and serviced every three months because of contaminated transformer oil. Throughout the ISOPur purification process, the substation has extended servicing to every six months and will look to reduce this expensive downtime to once per year. In addition to reduced costs, arcing has also been eliminated due to the enhanced condition of the oil. Renewed oil quality has resulted in a positive return on investment.

Graph 2: Con Ed Transformer Oil Tank Analysis

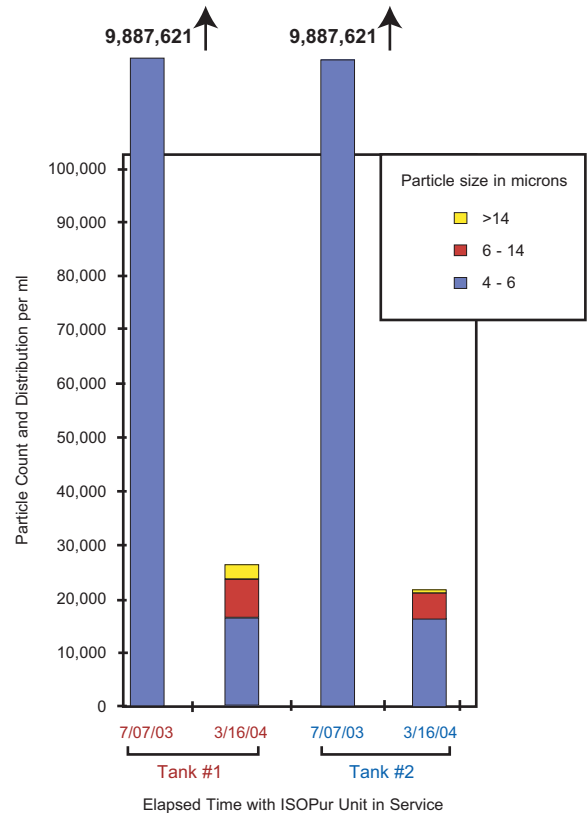


Figure 1: Before ISOPur (taken 04/03)



Figure 2: After ISOPur (taken 04/04)

