

**Take care, my friend.**

**-- Rip**



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my friend.**

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# Foreward

Rip was much more than the person who first had the idea that there should be an “ozone association”. After discussion with others, he became one of the founding fathers of the International Ozone Association (IOA). I recall first meeting Rip in 1983 at the IOA World Congress in Washington, DC. After presenting my paper, Rip was very complimentary and gave me encouragement about how I could contribute to the ozone industry. Indeed, I know that this encouraging trait that Rip had was experienced by others because I heard this same story from several “Young Ozone People” at the 2015 IOA World Congress in Barcelona, Spain.

Rip was my friend, mentor, travel mate and one of the kindest persons I know. After family and friends, his chief passion was ozone. Other passions were music, travel, Timberwolf (US Army WWII) military history, language, writing, local history and friend and encourager of others. I would classify Rip as an intellect with technical, language, art, music, and history intelligence, as well as a person with lots of emotional intelligence.

Ozone speaking, Rip traveled to Europe in the mid 1970’s to evaluate ozone in water treatment and report findings to the US EPA. He brought to the USA the consideration of biological filtration following ozone addition. Prior to that time,

industry practice in the USA was “clean” filters with pre-chlorine addition. Early on, Rip served as a technical consultant on many drinking water treatment plant ozone installations, including the consideration of biological filtration. At one time, Rip was editor of Ozone Science & Engineering (OS&E) and editor of Ozone News. He was author or co-author of 22 books which are available on Amazon (a list of publications is provided at the end of this book) and numerous IOA papers and presentations. Some of Rip’s recent advances in ozone of which I’m aware include ozone in Food Processing, Swimming Pools and Laundry.

I, and I’m sure all of us, will miss having Rip in our presence but his legacy will always be on our mind. Rip’s last words to me four days before he died were “take care my friend”, and I cherish those words immensely. At this, and every coming IOA PAG meeting, we will honor Rip and his contributions to the ozone industry and to the IOA.

“Take care my friend”

Kerwin Rakness  
July 2015

# **RIP G. RICE**

April 19, 1924 ~ June 3, 2015

Rip was born in Manhattan, New York City on April 19, 1924 of parents who had their roots in New Orleans, LA. The family moved many times during his early years -- his father owned a restaurant (The Cottage on West 34th Street) but became an alcoholic (as did many others) after the Stock Market Crash of 1929, then became an insurance salesman, before returning to the restaurant business again, then working for the Navy Department In Washington, DC.

Early residences (all in New York State) were Manhattan (several times), Long Island (Great Neck, Forest Hills, Garden City), Schenectady, Kenmore (suburb of Buffalo), and back to Manhattan.

## **An Early Music Lover**

As many of you already know, Rip is an accomplished musician, with keen interests in jazz and big band music. How did that come about? Rip is not certain, but recalls a significant event that happened very early in his life (age 5-7), when the family was living in Forest Hills, Long Island that may have been the start of his love for jazz music.

Rip had been struck by an auto, fracturing his right leg. This laid him up for a couple of months. His maternal grandfather, Irvin Fuerst (pronounced “First”), a very successful candy maker in New Orleans, moved to New York City where he became successful in the restaurant business. He owned a soda shop for teen-agers, was the first to make and sell raspberry sherbet, had a shop on the Atlantic City Boardwalk, and was also a successful Wall Street investor.

In his spare time, Granddaddy Irvin delved into

show business with Cecil B. DeMille (who had not yet entered the movie business) and a big name Broadway show producer, Jesse Lasky.

Granddaddy Irvin introduced his show biz friends to a female vocal group from New Orleans, the Boswell Sisters (Connie, Martha and Vet) who were in New York about to burst upon the entertainment scene.

One Sunday afternoon, while little Rippie was recovering from his broken leg, Granddaddy Irvin, some other gentlemen (probably including Jesse Lasky) and the Boswell Sisters came out to visit us, and to entertain little Rippie to perk him up.

Little did Rippie realize at the time what big show-biz stars these three ladies were going to become. But he remembers that the songs that they sang were peppy, they “swang” and were foot-tapping. And that Sunday afternoon “concert for Little Rippie” just might have started Rip’s love for swing and jazz music.





The Boswell Sisters (bottom to top) Connie, Martha and Vet.  
Recall that Connie had polio and could hardly walk.  
But what a vocalist!

## **The Family Moves to Texas**

When Rip was 15, the family (now comprised of younger sister Roxanne (born on Long Island) and younger brother Timothy (born in Schenectady, NY), moved to Fort Worth, TX, where Rip completed high school in June, 1941 and attended his first two years of college. It was in this junior college (now the University of Texas at Arlington) that Rip started playing saxophone with a passion, and soon became Leader of the school swing/dance band, the *Stardust Melodiers*, that played for many school dances.

## How Rip Got His Name

New acquaintances usually want to know how Rip got his name and if it is real or a nickname. Well, here's the story. Rip's father (George) was an only child, born in 1900, in New Orleans and for his first six years, essentially grew up on showboats, the **Old Rip**, and others owned and operated by his parents Captain Frank and Ruth Rice, that traveled up and down the Mississippi River<sup>1</sup>.

Actually, when George's mother Ruth was ready to deliver, the showboat docked at Greenwood, Mississippi to let Ruth get to the local hospital where little Georgie was born.

Then back on the showboat where George spent his early childhood.

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<sup>1</sup> Rip's younger brother (Timothy) has compiled the story of their paternal grandfather and his contributions to the Showboat Americana at the turn of the 20th century on the Mississippi River and its tributaries that is available in booklet form from Rip, entitled *Professor Frank H. Rice's Latest Sensation*.



In fact, little George Rice played in many of his father's showboat productions, usually portraying a midget -- sort of an early Munchkin, before L. Frank Baum invented them for *The Wizard of Oz*.

When George was six, and old enough to go to school, his father sold the showboat and bought a rooming house in New Orleans. Most tenants of the Rice Rooming House were showboat people, and little Georgie grew up being regaled with stories of showboat life, including stories of the "*Old Rip*" and other showboats operated by his parents.

Rip is the first born of his parents in 1924, and his father wanted to name him “Rip” after the “*Old Rip*”. But Rip’s maternal grandfather (Granddaddy Irvin Fuerst -- who was quite helpful to the young couple financially) didn’t like “Rip” for his first grandchild’s name, and so Rip’s parents named him “Ripdon”. But as Rip was growing up, this name was the butt of so much ridicule by his playmates that he just started calling himself “Rip”, and that was that.

## **And Then There Was World War II**

World War II interrupted Rip’s life (and all other American lives as well). Into the Army he went in the summer of 1943, taking basic training at Camp Fannin, in Tyler, Texas. Then on to the the Army Specialized Training Program in September, 1943 (Rip was assigned to Rutgers University, New Brunswick, NJ) and finally winding up in the 104th Infantry Division (the Timberwolves), Colorado Spring, CO in April of 1944.

The 104th Infantry was commanded by Major

General Terrence de la Mesa Allen (“Terrible Terry” Allen), who had commanded troops led by General George S. Patton that had invaded and fought in North Africa, and then Sicily.

General Allen had been sent back to the States to assume command of the 104th Infantry Division in March 1944 and he returned to France in early September, 1944 (D-Day +90 days) with the 104th in tow to help finish the war in Europe, which ended in early May, 1945.

### **Rip Becomes a Combat Engineer**

Rip’s two years at a Texas Junior College<sup>2</sup> started off with him taking a chemical engineering curriculum his first year. But Rip didn’t like engineering courses, so he switched to a chemistry curriculum for his second year.

But in 1943, when Rip went into the Army, his college record showed that Rip had taken a year of Chemical Engineering curriculum, and

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<sup>2</sup> then a junior college branch of Texas A&M, today the 4-year University of Texas at Arlington

in true military style, that “title” (“Engineer”) became fixed to his military record.

As a result, when the troop train carrying Rip (and hundreds of other fellow soldiers having completed basic training) arrived at Camp Carson (today Fort Carson) in Colorado Springs, CO, Rip was selected to join the 329th Engineering Battalion (part of the 104th Infantry Division).

What does a Combat Engineer do? First of all, he must be an above-average Combat Infantry- man. On top of this, he also learns to build bridges, destroy bridges, plant and decontaminate explosives, move heavy equipment from point to point, etc., all the while sustaining enemy fire.

### **Rip Becomes a Water Purifying Engineer**

In Rip’s words: “So I was initially assigned to “B” Company (one of three “line” companies of the 329th Engineering Battalion, and was learning how to build Bailey Bridges, handle

demolitions, etc. But after a week or two, the C.O. (Commanding Officer) of “B” Company called us out, stood us at “attention”, put us at ease and said, “Does anyone in this Company know the definition of “pH”?”

As a two-year chemist, I knew all about pH. But to raise my hand and let myself in for God and the C.O. only know what? -- well -- I was hesitant, to say the least. There is the old army rule -- “NEVER volunteer for anything”. So I stood silent.

“Come on men, SOMEbody must know the definition of pH!” Speak up !” said the C.O.

Slowly, and on its own initiative, my arm finally rose. “Sir! pH means potential of the hydrogen ion, Sir!”

“Fall out Rice! Company dis-MISSED!”, and the C.O then said to me -- “Get your gear together Rice and report to H&S (Headquarters & Services) Company. You are needed on the

Water Points (each having a 5-man team to purify water) there.”

So that’s how it happened, and the result for Rip was what he refers to as “The safest job in a World War II European combat zone.

Always far enough behind the “front” to escape small arms fire, yet not as far back as the Rear Echelon (sometimes 20 miles or so) to catch enemy artillery fire -- USUALLY.

Just prior to the Timberwolves sailing for Europe, we were given a week-long furlough to visit home and family before we got into the war.



Pfc Rip rice (right) and his father, George Rice, in front of their Fort Worth, TX home just prior to overseas duty  
July 1944



## **Off to France for Fun and Games**

The 104th Infantry Division landed in Cherbourg, France on Sept. 8th, 1944 (D -Day was June 6) in the first convoy to sail directly from New York to France (rather than going through England). This is because the Germans had destroyed the harbor at Cherbourg on D-Day and it took 90 days for the Allies to clear the harbor to be able to receive shipping.

“The Timberwolves drove through Paris a few days after its liberation, then into Belgium, then entered actual combat in the Netherlands in late October, 1944. In late November, we were sent into Germany (crossing the Siegfried line just outside of Aachen, and reached D ren (on the Rohr River) just as winter (the most severe in history at that time) set in.

We were on the edge of the area that became “the Battle of the Bulge” in mid-December 1944, but were never directly involved in that bloodiest European battle of WW-II, and in February 1945, the 104th crossed the Rohr

with the immediate objective of reaching the west bank of the Rhine River.

### **Crossing the Rhine River -- Unexpectedly**

Top brass had assumed that the Germans (who had destroyed all bridges crossing the Rhine except for the Ludendorff railroad bridge at Remagen (pronounced Ray-mahgen) -- a few miles south of Bonn -- would blow up the Remagen bridge. Had the Germans destroyed this bridge, top brass (General Eisenhower et al.) was anticipating another D-Day Normandy type of invasion, although on a smaller scale.

Fortunately for us Americans, that bridge was not destroyed when planned, partly because some of the German explosive charges were faulty and did not blow when triggered, partly due to procrastination by the German Major in command, who wanted to let as many German civilians and military units as possible cross the Rhine from the west to the east bank, and partly because of a daring U.S. Combat Engineer Lieutenant (Lt. Timmerman) who with

a squad of 12 troops happened to arrive at the west bank of the bridge at just the “right time”.

Lt. Timmerman realized that if he and his men could crawl under the bridge planks and cut the demolition wires, they might be able to save the bridge -- which they did, but under very heavy fire from Germans on the East side of the Rhine (remember the movie, *The Bridge at Remagen*? That was as historically accurate as Hollywood ever gets, at least as far as the heroics of Lt. Timmerman and his squad are concerned).

On the other hand, the Ludendorf Bridge had been heavily damaged and under a smoke screen (to hide Allied movements from German artillery observers on the East side of the Rhine), combat engineers built a pontoon bridge about a quarter mile upstream of the damaged Ludendorf bridge. The pontoon bridge is the one my unit crossed the next morning.



Rip took this photo from atop his water point truck, crossing the Rhine in March, 1945. Note that much of the covering smoke screen is still hanging over the Rhine

The 104th Division crossed the Rhine the day after the bridge had been captured (March 7, 1945), and Rip's water point was the first water point to cross the Rhine. From there the 104th surrounded the Ruhr Valley area (Düsseldorf, etc.), then jumped off to the East -- toward Kassel, the Marburgs, Nordhausen, and ultimately, Halle on the Saale River (near Leipzig), and finally Delitsch, near the Mulde River, where our 104th troops met the Russians.

## **Nordhausen -- Unbelievable Horrors**

“As our water point was perhaps 20-30 miles from Nordhausen on April 10-12th (as I recall), 1945, we started noticing a peculiar odor in the air. The closer to Nordhausen we came, the stronger this odor became, until it became a very disagreeable stench. What in the world is this?

As we were passing by the road to Nordhausen, on our way to Halle, an MP stopped us (remember, we were only five men with our water purification equipment on a large military truck). The MP advised that the C.O. had ordered all units heading East to go into Nordhausen to see something incredible. So on toward Nordhausen we went, and the word “incredible” was much too mild for what we saw.

By now, all readers probably are aware of Hitler’s concentration camps and of the horrors perpetrated on their inmates, generally lumped together under the term “The Holocaust”. There

was such a camp just outside of Nordhausen, and officers wanted to be sure that all personnel saw, with their own eyes, what the word “horror” actually means. Stacks of dead and rotting corpses, and still-living prisoners who had been literally starved to living skeletons (except with their skins intact).

I don’t need to continue describing this. I am not even sure that I will ever find the right words to describe it anyway. Suffice it to say, all persons seeing this revolting sight, and smelling the foul stench tossed their cookies, and those scenes will always be in their memories.

“This is why we are fighting this war men -- to prevent atrocities like this from ever happening in the free world” -- or words to that effect.

I was too sick to listen to anything that was being said. I was struggling with every ounce of energy still left in me just to maintain any equanimity that I had remaining.

The stench alone was stomach-turning. It consisted of the odors of decaying human flesh, plus odors of human bodies being incinerated (the number of dead bodies constantly being “produced” outnumbered the capacity of the 2-3 ovens to incinerate them), and I don’t know what else that stench was all about.

This stench reminded me of the odors around the stockyards on the north side of Fort Worth, TX, but that odor was more like rotting manure, and certainly was not as sickening as the stench at Nordhausen.

At the time, we had no knowledge of who these victims were, nor of concentration camps for that matter. We did not know at the time that Hitler was bent on eradicating the entire Jewish race in all parts of Europe under his control. I could only conclude at the time that ALL Germans (and I am half-German in ancestry) had a part in this inhumane treatment of fellow human beings. I simply could not tolerate that.

However, something then happened that caused me to change that conclusion about ALL Germans being at fault. While we were standing in the courtyard where these decaying and still-living skeletons had been gathered, and having recovered our composure to some extent, came a column of German civilians from the town of Nordhausen, at gunpoint.

The American C.O. of the unit that had liberated this camp had ordered his men to go into town and bring all Nordhausen residents up to the courtyard to witness this sight. Keep in mind, the stench described earlier covered at least a 20-30 mile radius. That means that

Nordhausen residents had been living with this stench for as long as this camp had been in existence -- a year or two -- as I learned later on, but of course, there was nothing they could do about it, except learn to tolerate it.

Yet every German civilian brought to this courtyard at the point of an American rifle, had



the same reaction we G.I.s had experienced -- sickening nausea and moans of horror, that I believe were not feigned. That led me to conclude that at least these Nordhausen Germans (a) must have known that bad things had been going on at this camp (from the constant revolting stench, day and night), and (b) were as sickened as were we who had not had to live with the stench for as long as they, so that (c) there was SOME hope that not ALL Germans were guilty of these atrocities.

Later we were told that the Nordhausen civilians were put to work moving and burying the camp victims with respect and with whatever dignity could be mustered under these atrocious circumstances.

My water point was in Nordhausen for only an hour or two, which allowed me to take some photos (yes folks, I was also an amateur photographer, and could develop film and make prints, as long as I could create a darkroom and could scrounge the necessary chemicals.

In that respect, I was a precursor of Radar O'Reilly of MASH). And I still have some of these photos, now stored in my computer. Here are a few that have survived:





Insert from Rip: Dear Reader -- don't you EVER believe anyone who says, "the Holocaust never happened." Anyone who says that wasn't there. I was!!

## **The German V-1 and V-2 Rockets**

After we left Nordhausen and before we reached Halle, we were advised that there was more to the Nordhausen story than just this assumed-to-be concentration camp.

The Germans had been building V-1 and V-2 rockets in several of the nearby Harz Mountains -- just outside of Nordhausen. Still later, we learned that the “camp” outside of Nordhausen was a slave labor camp for manpower to build the German rockets that had been raining down on England, as well as on American troops, for some time.

In fact, Dr. Werner von Braun and his rocket scientists were housed in the Nordhausen rocket factories. As soon as the factory was captured, Dr. von Braun and his staff surrendered to the Americans, were brought to the USA, put in charge of the NASA Rocket program, and the net results are moon landings, space ships to Mars and to distant stretches of our solar system.

It is mind-boggling to think of where we Americans might be if von Braun and his staff had been captured by the Russians in April of 1945. Although there were German rocket scientists in some of Germany's eastern rocket launching sites that the Russians did capture, the main German concentration of missiles for firing to the West -- specifically to what is now the UK, and on Allied troop targets was in Nordhausen, along with the outstanding German cadre of rocket scientists.

### **On to Halle on the Saale River**

The 104th Infantry kept going East to Halle, arriving on its outskirts the evening of April 18, 1945. Halle was the last major sized German city that our division would be chosen to take, and as I learned years later, was rather unique -- for several reasons:

1. It was a very old city with deep involvements in the arts.
2. Many Allied wounded and prisoners of war were being cared for in Halle hospitals,

3. The German commander was an SS General with many Hitler Jugend (youths) and his orders from Hitler were “no surrender”.
4. Halle is the home of a famous German zeppelin pilot of WW-I, who later had visited the USA, which he liked very much.

More about what all this means later. For the moment, back to the evening of April 18, 1945. My water point was advised to be ready to move into Halle the morning of April 19th (my 21st birthday), and that 104th Division troops were going to take Halle this night. We should expect “one Hell of a fight”. English translation: “You won’t get much sleep because of the anticipated battle noises.”

However, we had a very good night’s sleep, with only a few sounds of our artillery firing a few rounds into town in the middle of the night. There was no “Hell of a battle” after all.

So after we set up our water point on the 19th in the middle of Halle, had filled our water tank, and started to receive unit jeeps and weapons carriers 5-gallon water cans, I asked the various drivers, "Why did the anticipated big battle not happen last night?" Many responses were "we have no idea", but several people recounted this strange story:

"There was this guy in the German underground who outfitted a bike with pots and pans and rode around the south part of town (where the SS troops and Hitler Jugend were positioned) mentally recording their positions. He then rode through German lines, then to our lines (where he was almost killed), asked for the American commander, and drew him a map of where the German defenders were set up.

The on-scene American commander (104th Division) quickly called for surgical artillery strikes on the specific buildings cited by the underground guy. The German defenders quickly surrendered, and the city fell without

a major razing. Countless lives were saved because of this brave fellow.”

This story of the underground pots and pans peddler was told to me several times on April 19th by different GIs who drew water that morning. A story that strange stayed with me for years, and its equally amazing end will be revealed later in this booklet, in about 1967.

After a few days in Halle, our water point ended its European “tour” in a small town named Delitsch, about 20-30 miles east of Halle, close to the Mulde River, where some units of our 104th Infantry Division met Russian soldiers.

Our division had set a record for consecutive days in combat, October 1944 to May 1945, without relief -- almost 200 days.

### **And So Back to the States**

After Germany surrendered, May 7, 1945, the 104th Division rode captured box cars (the same box cars used to transport captives to the



infamous concentration camps) from central Germany just south of Berlin to Le Havre, France. No seats, no beds, just straw for the floor, and pit stops every hour or so. As I recall, this trip required 2-3 days -- with no dining car, etc.

At Le Havre, we boarded a former U.S. Matson Lines cruise ship, returned to New York Harbor, were given a 30-day leave and told that we would re-assemble on the West Coast to train for the coming invasion of Japan (Operation Downfall).

### **Preparing to Invade Japan**

Our west coast quarters were at San Luis Obispo, CA, about halfway between San Francisco and Los Angeles. Our Division re-assembled there in mid-June, 1945 and began modifying our equipment for Japanese terrains, and learning what precious little was known about Japanese raw water qualities. We were scheduled to board troop transport ships in mid-August.

## **The Atomic Bombs -- August 1945**

Fortunately for the 104th Timberwolves, shortly after the atomic and plutonium bombs were dropped on Hiroshima (August 5) and then Nagasaki (August 8), followed by massive fire bombings of the larger Japanese cities, and the entry of Russia into the War (August 10, 1945) by invading the the Japanese Empire on the Chinese mainland (including Manchuria and Korea), Japan surrendered and the war came to an end on August 15, 1945. Otherwise, the Timberwolves (and many other U.S. military divisions) were scheduled to invade the Japanese homeland.

In fact, the plan for Operation Downfall (the invasion of Japan, and which we were not advised until 1996 when much WW-II information was declassified) had the 104th Infantry Division scheduled to be part of the second wave of American military units invading Tokyo itself, via Tokyo Bay in early 1947. Had that invasion actually happened, Rip might not have returned home, since about one

million American casualties had been estimated by American intelligence sources of that time period.

And for those do-gooders who have castigated President Harry Truman for deciding to drop the atomic bombs, arguing ever since WW-II ended that the Japanese were going to surrender very soon anyway. A recently released Military Channel documentary<sup>3</sup> should finally change their minds.

This documentary, based upon fact and hard physical evidence reveals that the Japanese had developed an underwater aircraft carrier in the later stages of WW-II. This vehicle was a huge submarine, carrying three attack bomber aircraft and a foldable flight deck. The Japanese were to be supplied with bombs containing “dirty” nuclear materials made in Germany with Uranium 234/235.

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<sup>3</sup> *Dead Men's Secrets: Hitler's Nuclear Arsenal*, Oct. 10, 2003, the Military History Channel.

These “dirty” nuclear bombs were being transported from Germany to Japan by an equally huge German submarine that, fortunately for Americans, was destroyed somewhere in the Atlantic Ocean.

Had these “dirty” bombs been delivered to Japan, they were scheduled to be dropped on San Francisco, CA by the Japanese on August 17, 1945. Thousands of Americans in the San Francisco area would have been killed by exposure to the nuclear radiation.

Adolf Hitler and the Japanese were within only 11 days of dropping Axis nuclear weapons!

A toast to Harry Truman, as often as I think about otherwise not being here to write this missive. Thank you, Sir! You were right!!

### **Post World War II Life for a New Veteran**

During the War, Rip’s family moved from Texas to Washington, DC, where his dad now was working in the Navy Department and his mom

for the Army Air Force at the Pentagon. Rip finished undergraduate work in Chemistry at George Washington University in 1947, then went to Catholic University (within walking distance of his parents' D.C. home) and took courses pointed at obtaining a Master's Degree in Chemistry.

However, his grades at GWU were not all that great -- he just eked out his B.S. degree, and when interviewed by the C.U Chemistry Dept. Chairman, Dr. Francis O. Rice (no relation to Rip's family), he said, "well Mr. Rice, I'm going to ask you to take an English test before I decide to admit you or not."

That statement caused great upset in my mind. What in the world does English language perfection have to do with chemistry at the bench? The answer? "If you succeed in producing new chemicals and finding uses for them, you are going to have to tell the world what you have done. And you must be able to do this in writing, presumably in English. Take

this test.” So I took the test and really didn’t do too well. Nevertheless, Prof. Rice admitted me provisionally.

One of the courses on the curriculum was Chemistry Lab -- three hours daily for three days weekly. But did the students do chemistry in this lab? Not for the first couple of months.

It seems that the lab had been closed all through WW-II, and, exacerbating its problems, the lab had been there for years without appropriate maintenance. In particular, the electrical outlets in the lab did not work, necessitating rewiring essentially the entire lab.

Who does that? “Well, Mr. Rice, since you are here, and we do not have electricians on the University staff (incredible!) and since we don’t have funds to hire an electrical repair firm, YOU are elected. What tools do you think you will need? We have pliers, screwdrivers and wrenches.”

What kind of a graduate school did I get myself into? I want to learn Chemistry, but these clowns want me to learn English and to write and to rewire the lab for them.

At the same time, I was taking class courses. I guess that I must have developed a “poor attitude” toward learning. After all, I had just returned from 19 months in a pretty serious war, followed by two years at George Washington U. (where two out of the five chemistry profs I had were more interested in telling us how great they were than in teaching us something). So maybe I just wasn’t mentally ready for another 2-3 years of being pushed around doing things I did not want to do.

So I quit my chemistry studies and enrolled in the music school of Sisters’ College -- part of the Catholic University -- and was playing in the Harry Vincent Orchestra (later to become the Music Makers), a 9-piece dance band, playing jobs around town on weekend nights.



Rip in the Harry Vincent Orchestra, ca 1949.  
Rip is in front of the drums.

Yup -- music was my thing. Cracking out good grades in all my music courses, learning to play clarinet fairly well and piano (they had told me “We know you know how to play saxophone -- now learn some other instruments and show us that you really ARE a musician.”) OK -- I could buy that argument.

### **Enter the Love of Rip’s Life**

By this time Rip was Leader of this formerly Harry Vincent band, now renamed The Music Makers. He was also knocking out straight A grades in music courses, but then, one fateful Sunday afternoon (March 17, 1948 to be



specific), he had a blind date with one Billie Gean Womack and was totally smitten. Exactly 100 days later (June 26, 1948), the two were married.

Why did it take Rip 100 days to get Billie to the alter? Because Billie was working at the FBI and Rip was “dawdling around” in music school while holding a B.S. in Chemistry. “You academic bum!”, she said, effectively -- “You have a college degree in chemistry, have no job, nor any foreseeable future of a “real” job, and are fiddling around in music school!! And you want to get married? Get off your duff and get a job!! Then we’ll talk about marriage!

Rip dutifully said, “Yes ma’am”, and off he went to find a job as an Analytical Chemist at the then National Bureau of Standards (now the National Institutes of Standards and Technology). After his first two paychecks came in, and Billie was fairly certain of his intentions, she acquiesced, and their marriage was finally consummated.



Wedding Day: Billie & Rip Rice  
Washington, DC, June 26, 1948

In early 1949, the couple were blessed with a son, David Womack Rice, a red-headed son (Rip's father and Billie's mother both had red hair), a perfect baby in all respects, except that he was two months premature (ears still in his skull, and no fingernails or toenails. But that all worked out very well for the new family. Dave was a healthy child.

## **A Second Attempt at Graduate School**

Things went along just fine for the new Rip & Billie Rice family. Both parents were working and Rip was playing 2-3 nights weekly with the Music Makers. Then one Saturday morning in early 1951 after breakfast, when David was two years old, Billie noted an item in the newspaper that alerted WW II veterans that they had to be enrolled in a college course by a date certain or lose the balance of their GI Bill of Rights' college support funds.

“Sweetheart”, Billie asked, “How much GI Bill college time do you have left?”

“Oh, about 18-20 months” was Rip’s reply.

“Well then, what are you doing sitting around here? Get off your duff and enroll in a graduate program. Go get a Ph.D.!”

It did Rip no good to explain that after receiving his B.S. from GWU, he had tried graduate studies in chemistry at Catholic U, and had

withdrawn before he would have flunked out. That's why he then went to Sisters College, to learn more about music.

"Then was then. Now is now!! You have something to work for now -- me and Davey. You were just playing around then! Are there only one or two Ph.D. Chemists in the USA? No. So go DO IT!" And the rest -- as the saying goes -- is history. Rip kept working full-time, kept playing music, but enrolled at the University of Maryland Graduate School nights and weekends. Although it took two years longer than had he been able to attend full-time, nevertheless, six years later, June 1957, Dr. Rip G. Rice emerged, a newly-crowned Terrapin Ph.D. (Organic Chemistry major), ready to take on the world. From this point (1957) until 1994, Rip's sax playing (but not his love for swing music) was put on hold while he established a career as a Chemist and wherever that experience led him, professionally.



Billie and son David Womack Rice, 1956, on the Boardwalk in Atlantic City. (photo by Rip)

## **A New Career for Dr. Rip**

The Rip Rice family moved to Ft. Worth, TX, in June 1957, where Rip had accepted a position with the General Dynamics Corporation, Convair Division (aircraft construction), where the B-58 (first supersonic bomber) was being built and tested. His primary responsibility was as a member of Convair's Bonded Structures Section, where adhesive bonding of various

components of an aircraft was a key technology in producing this new airplane. Someone skilled in what organic polymers are all about was needed essentially on the aircraft production line, and Rip's experiences and education fit the bill.

Rip also was given a small laboratory and a technician where he could test out some of his research ideas about synthesizing high temperature-resistant polymers that might be formulated into paints, lubricants, coatings, adhesives, etc. to resist the ever-increasing temperatures encountered by supersonic aircraft. In this laboratory, he discovered a new class of combined phosphorus-nitrogen, inorganic-organic, polymers that showed promise.

As a result, Rip was transferred to the GD Convair Aeronautics Division in San Diego in November 1958 to become the Technical Director of High Temperature Polymers within the newly-formed GD Advanced Projects

Department. The family enjoyed three years of San Diego's bliss and happiness, before the Model 800 and 990 airplane fiascos caused GD to terminate many of its fringe activities.

Rip's entire R&D group (~20 people) had to be terminated in early 1962. But Rip's chemistry and high temperature polymers services were wanted by the W.R. Grace & Co., Research Division, in Clarksville, MD, and so the family moved to Silver Spring then in 1964 to Ashton, MD, where they lived the next 40 years, until Rip and Billie moved into Brooke Grove in late 2004.

Along the way many career changes happened to Rip, some by choice, others not. He entered Convair/Ft. Worth as a Chemist, but quickly became Technical Advisor on the B-58 production line, advising on chemical aspects associated with adhesives, coatings, lubricants, fuels, etc.

In San Diego he was named Technical Director

of GD's newly formed Advanced Projects Division. At W.R. Grace & Co. (Clarksville, MD), he started as Research Chemist in the Inorganic Research Department, but five years later (1967) he was promoted to Director, Government Contract Relations, and when he took over this role, part two of the story of why during World War II the German town of Halle fell without a major battle was clarified, to wit:

My Assistant Director was a Dr. George Braude, a gentleman about my age with a Germanic accent. During lunch in his office one day, George asked about my background, which led me back to WW II and the U.S. Army in Europe. When I mentioned that I was in the 104th Infantry, George lit up and said, "I know a lot about the 104th. Were you in Halle?". When I replied in the affirmative, he asked what I remembered about the fall of Halle.

I recounted the story I had been told about this German underground hero on his pots-and-pans bicycle. George said, "What a



coincidence! I was that guy!” Then we talked about many of the underground activities George had performed while he was a Ph.D. student at the University of Halle during the War<sup>4</sup>.

However, in 1972, Grace management decided to terminate Government contract research, so Rip’s group was downsized.

### **1971 -- Enter Ozone Technology**

By this time (1971) the New Ventures Department of the Davison Division of W.R. Grace & Co. had licensed a new type of ozone generator, which showed much promise for treatment of wastewater (for replacing chlorine that was causing massive fish-kills in rivers and streams receiving chlorine-disinfected wastewater treatment plant discharges).

The Davison group did not know much about the machinations of government agencies,

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<sup>4</sup> Rice, R.G., “The Fall of Halle”, in Clark, K.P., War Stories of WWII (Mennonite Press, Inc., Newton, KS, 2011, pp. 460-462.

but Rip surely did, and he represented for a time the Davison Division of Grace, calling on government agencies to advise and educate them about the potential benefits of this magic chemical called “ozone”.

### **Downsizing Happened Again**

In 1972, the Grace Research Division was required by Grace management to downsize by a significant fraction. Rip was caught in this downsizing, primarily because his Research Division boss assumed that he would be transferred to Davison’s New Ventures Department, where Rip had been spending perhaps half of his time representing them to Government agencies.

But Rip had different ideas. He recognized that ozone for treatment of polluted waters and wastewaters had great promise. And so, seizing this opportunity, Rip left Grace, hung out his shingle as “Washington Representative”, and set about finding clients to represent to government agencies. His first

client was the Grace Co.'s Davison Division, then a few years later, the Grace Research Division itself.

As their Washington Representative, the Davison New Ventures Department at Grace said, "Rice, we want you to take the Gospel of Ozone to the Feds." Rip asked, "What is the Gospel of Ozone?" "We don't know -- that's for you to find out."

So off Rip went, trying to find some established association knowledgeable in ozone technology. There was none at the time (1972-73). Just then, three events happened rather coincidentally and nearly simultaneously:

1. An epidemiological study conducted on New Orleans drinking water (heavily chlorinated) showed statistically increased levels of cancer in the population of New Orleans known to have been drinking such waters for years. This caused the Safe Drinking Water Act to roll through the Congress and

to aid the expansion of the EPA's Drinking Water Division. It also stimulated a strong interest on the part of the EPA in European use of ozone for treating potable water -- something that was in rather wide use in France, Belgium, Switzerland, Germany and the Netherlands at the time.

2. Arab oil producers artificially raised the price of crude oil, thus increasing energy costs throughout the world significantly. Adoption of ozone technology might be one way to lower costs, at least in the water and wastewater fields in the USA. The Department of Energy was created and interest in new, energy-savings technologies, was expressed.
3. Seizing another opportunity, Rip decided the time was right to form an International Ozone Association, a not-for-profit, scientific and educational organization whose mission would be to gather and disseminate information about the manufacture, application and uses for this very strong disinfectant and oxidant, that showed

much promise for replacing halogenating materials, all for the benefit of mankind.

So Rip co-founded the IOA in early 1974, and 40 years later, the Association has grown to become a respected scientific association, with members and chapters all over the world (the latest being in China).

This geographic expansion of the IOA has allowed Rip to learn much from those in the ozone business all around the world, and to become a recognized international authority in ozone technologies. Rip served as IOA's International President during 1982 and 1983, and is a permanent member of the IOA's Board of Directors.

Run a Google search on "Rip G. Rice" and you will have most of Rip's ozone qualifications. But be sure to insert the middle initial. If you just Google "Rip Rice", you will intermix Rip with a professional tennis player of the same name.



Rip Rice, IOA International President,  
1982-1983

### **An “Engineer” Once Again**

Keep in mind that in 1972-73, Rip was skilled in the art of Washington representation, but he was no expert (yet) in ozone technologies. That expertise came later. One of Rip’s early clients was the Jacobs Engineering Group (Pasadena, CA), and their initial need for Rip’s talents was to locate and help win government funds for engineering projects that Jacobs was particularly good at performing (none of which involved ozone technology).

The Jacobs-Rice relationship proved so fruitful for Jacobs that in 1977, Jacobs made Rip the proverbial “offer he could not refuse”, and Rip

became the Washington Office Manager for Jacobs Engineering, full-time, but was allowed to continue most of his ozone commitments, but on the side, as long as there was not conflicts of interests with Jacobs' projects.

However, after five years, Jacobs wanted Rip to move to Pasadena but continue managing the Washington Office activities from California.

In Rip's opinion, this couldn't possibly work out well for either party, so in 1982, he left Jacobs, and hung out his shingle again, this time as "Ozone Consultant". And that shingle remains visible even today, retirement community or not. Rip's profession as an Ozone Consultant allows him to travel the world, attending meetings of the International Ozone Association, consulting for firms in many countries new to ozone, and assisting firms already in ozone businesses to better understand and enter new application areas. When Rip became involved with ozone in the 1970s, the major markets for ozone were drinking water (Europe) and odor control

(USA and Japan). Today, while those original markets remain, ozone is growing rapidly in Agri-Foods, institutional laundries, wastewater, swimming and aquatic pools, cooling towers, air treatment, marine aquaria<sup>5</sup> and many other applications.

### **Back Into Music -- 1994**

But ozone is not Rip's only professional interest. In 1994, his son David, by then a practicing dentist and fine musician (euphonium, tuba, trumpet playing in several bands) on the side, convinced Rip that now was the time for him to come out of musical retirement and take up his old sax-playing hobby once again. Rip agreed, with the objective of playing in at least one band with David.

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5 FYI -- without the availability of ozone, there would be no possibility for today's marine aquaria to exist. Marine mammal wastewaters cannot be discharged to marine environments without treatment to meet U.S. EPA discharge requirements. Thus marine aquaria wastewaters are treated for recycle and reuse using ozone and biofiltration. Without ozone, there would be no beluga whales, no Shamu orcas, no porpoises, etc. in captivity. Hail to thee, ozone!



At the time, Dave was a stalwart euphonium and tuba player in the Rockville Concert Band, in the Rockville Brass Band, and had formed and was directing the Fugitive Brass Quintet. Of these, only the Rockville Concert Band offered any opportunity for a tenor saxophone player. But the RCB already had its quota of four sax players, and Rip's only recourse was to join the RCB's clarinet section, which he did.

Shortly thereafter, Rip found that there was room for a tenor sax in the Columbia Concert Band, which he quickly joined, and at the same time, he joined the Columbia Jazz Band (the CCB) as well. Then Dave quickly joined the CCB (playing tuba) as well to be playing music with his dad.



Rip soloing with the Columbia Concert Band

A bit later, the Columbia Jazz Ensemble made room for Dave on trumpet (Dave's musical career began with clarinet, then trumpet -- but diabetes had forced him to lay off trumpet for many years). And finally, the Rockville Concert Band asked Rip to form a Dixieland combo, which he did -- the Rockville Dixie Rascals. Dave became the Rascals' trumpet player, and of course, Rip played tenor sax and later washboard.



Rip playing "When Sunny Gets Blue" with  
the Columbia Jazz Band

So by 1997, Rip and Dave were playing together in FIVE bands -- truly a wonderful time in both of their lives. And having the charming and very proud Billie in the audiences spurred both of them on to ever- greater heights.



The Rockville Dixie Rascals  
Dave Rice trumpet, Rip Rice tenor sax

## Playing Jazz Overseas

Word quickly spread throughout the International Ozone Community that Rip was playing his saxophone once more. As a result, when Rip was going to attend IOA meetings overseas, the local arrangements committees oftentimes coupled evening entertainment activities to allow Rip to participate. His first “action” was with a Dutch jazz band in Amsterdam, Holland in the late 1990s.



And for the IOA's World Congress in Kyoto, Japan (1997). the organizers had hired the Far East Ellington Lovers' jazz band (the F.E.E.L. band), with whom Rip was the featured guest performer for several numbers. This Kyoto gig was, in Rip's words, "the musical highlight of my career. None of these kids could speak much English, and I surely couldn't speak much Japanese. But boy oh boy, did we ever SWING!!! What a great evening it was for me, and I know they had lots of fun as well.



Rip soloing with the Kyoto University F.E.E.L. big band (1997)

At the end of our rehearsed performances, the audience wouldn't let us get away, and demanded an encore. The F.E.E.L. band leader asked in his best English, with a puzzled look on his face, "Dockta Lice, what we pray now?"

(we had played everything we had rehearsed earlier). So I said, “we have played the C-Jam Blues (which is in the key of C). How about we jam that same number in Bb? and call it theB-Flat Jam Blues”

The Leader responded, “Ok, glate idea -- we pray B-frat Jam Broose”, and quickly turned around and gave the band instructions in Japanese, and off we went -- for another 10-15 minutes, with everyone in the band soloing at one point or another.

### **A Timberwolf Retraces Some WW-II Tracks (2002)**

In the fall of 2002, the IOA held an important ozone meeting in Amsterdam, The Netherlands, and Rip and Billie attended this meeting, along with several of their friends. After the meeting, Rip had pre-arranged (with the assistance of the National Timberwolf Association and others) to revisit some of the spots in The Netherlands and Germany where the 104th Timberwolves had fought during WW-II.

Three places were of particular interest to Rip - Breda (Netherlands), then Nordhausen and Halle (Germany), for reasons that will become apparent from the following discussions.

### **Breda, The Netherlands**

The Timberwolves had entered combat in southern Holland in late October, 1944, liberating the small towns of Zundert and Achtmaal, before moving northward to Breda and further. My water point was set up a few miles from Breda, in the country, by a flowing stream.

Before this 2002 visit to Europe, I had learned that the people of Zundert and Achtmaal not only remembered their liberators of WW-II, but have memorialized the 104th Infantry by posting signs at key points, naming a large thoroughfare "Timberwolf Road", and things of that sort. But further, the youths of these villagers also have formed a "Dutch Timberwolves" unit (not associated with the Dutch military), and annually, these Dutch

Timberwolves hold a week-long war games reenactment of the Timberwolves liberating their towns. And these activities continue to this day.

Additionally, two young Dutch brothers, in their teens in 2002, had taken over their parents' garage in Achtmaal, and converted it into a World War II Museum. I wanted to see all that.

And so our group of Americans met the Dutch Timberwolves (in Timberwolf uniforms, complete with Timberwolf shoulder patches and driving WW-II jeeps), in the town of Breda, and were treated like visiting royalty. After meeting us at our hotel, they took us to Zundert and Achtmaal and showed us the route the liberating Timberwolves took back in 1944.

We were introduced to the mayors of both towns, and everywhere I went, I was thanked for being one of their Liberators. I was really moved by all of this, and so impressed that even after 58 years, not only did those

who were alive at that time remember their liberation, but also their children and grandchildren and been taught what would have been their future had the Americans not liberated their parents.

A few pictures of that memorable event are shown below:



Rip with Dutch Timberwolves, 2002





Zundert memorial to the Timberwolves



The Oostvogels (Achtmaal, Netherlands)  
Timberwolf (WW-II) Museum



The Oostvogels brothers (Tuen & Bart),  
founders and keepers of the Achtmaal WW-II Museum,  
dedicated to the Timberwolves



At the Achtmaal WW-II Museum

## **Nordhausen, Germany, 2002**

Prior to this visit, I was put in contact with a former Mayor of Nordhausen who, during the War, was a 10-year old boy when the town was liberated in early April, 1945. When we arrived, it was once again a celebratory event. We were given the full red carpet reception, and I was even interviewed for an upcoming documentary on "*Nordhausen -- Its' First 1,000 years*".

When I was originally in Nordhausen just after our Division had liberated the Dora-Mittelbau slave labor camp on April 12, 1945, we were there only for an hour or so. In 2002, however, we spent two nights and the included day. We were given a guided tour through the mountain

caves where the V-1 and V-2 rockets were made. Some of this I had seen in a *Modern Marvels* documentary a year or so before this visit.

Next we were shown the building containing the two ovens used for cremating the dead bodies. We also learned that the building housing these ovens had been mounted deliberately on top of a small hill so that ashes from the ovens could be dumped and would slide down the hill. Over the year or two of this operation, the hill grew in size. After liberation, grass was planted over the ashes, and today the hill looks like a normal hill.



One of the two crematorium ovens in the Dora Mittelbau slave labor camp (Nordhausen)

At the base of the hill, however, is a memorial plaque listing the names of countries of slave laborers who were at this camp. Note that “US-Amerikaner” is listed -- meaning that there were some Americans who had been impressed into slave labor status to help build the German rockets.



List of countries from which slave laborers were impressed in the Dora slave labor camp



Reconditioned and preserved slave labor barracks at the Dora Mittelbau slave labor camp, Nordhausen

We were then taken through the Museum of the Dora-Mittelbau Slave Labor Camp, wherein the full story of the WW-II events at this site is told. I asked the museum director about the “US-Ameri-kaner” listing on the plaque near the ovens. I specifically wanted to know if any information is available about the identity of Amerikaners and how they came to be there. The director promised to see what information was available and send me copies, but I have never heard from him with the requested names of Americans.

### **Return to Halle, on the Saale River**

Prior to setting up our visit to this town, I learned from the National Timberwolf Association that much information was now available on Halle and its fall to the 104th Infantry Division.

The daughter of one of the Colonels commanding one of the 104th infantry battalions at Halle (Col. Clark, daughter Kathy Clark) had written a Master’s Degree thesis

*on The Battle of Halle -- 15-19 April, 1945  
-- A Study in How American Soldiers and the  
German People Saved a City from Destruction  
Near the End of World War II.*<sup>6</sup>

Miss Clark graciously sent me a copy of her thesis, which was fascinating to me to read. First off, there was no mention of the “pots- and-pans” exploits of my friend, George Braude, on the night of April 18, 1945. However, there was reference to “surgical artillery strikes” being lobbed into buildings in the south of Halle where German SS troops had been positioned. Shortly after this, the Germans surrendered and Halle was occupied by the Timberwolves on April 19th.

There was much discussion about the attempts by Count Graf von Luckner, Halle resident, and former pilot of German Zeppelins in World War I. Count von Luckner knew the

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6 by K. Porter Clark, submitted to Sonoma State University (CA) in partial fulfillment of the requirements for the degree of Master of Arts in History, December 1998.

Americans, knew they could wipe out his beloved Halle, and did not want this to happen.

And so, Count von Luckner had spent a week or more of trying to negotiate between the Halle SS commander (whose orders were “no surrender” and General Terry Allen (commanding the 104th Infantry Division) and his officers, including Miss Clark’s father, Col. Clark.

When I spoke with Miss Clark about her thesis and my experiences, she admitted that the name Dr. George Braude was known to her, that she knew that Braude was a member of the German underground in Halle, and was part of the negotiating team of Count von Luckner. However, so little information on Dr. Braude was available, that she could say nothing about him in her thesis.

On the other hand, in her thesis, she also pointed out a book, being written at the time (1998) in German by Mathias Mauer, a Halle

native, a lawyer and its town Historian, on the Fall of Halle. She gave me contact information for Herr Maurer.

Mathias Maurer sent me a copy of his new book (in German), and I was able to find a reference to “a Dr. Braude” who accompanied Count von Luckner on several meetings with the Timberwolf top brass during the week preceding April 19th, 1945. But as with Kathy Clark, so little information was available about Dr. Braude, that Maurer could say nothing more in his book.

Neither Kathy Clark nor Mathias Maurer had any knowledge of the pots-and-pans heroic actions of Dr. Braude on the night of April 18, as reported by several Timberwolves to me on April 19 while obtaining water at my water point in Halle.

With this knowledge from Clark and Maurer, I went to see my old friend George Braude, who was living near Annapolis at the time. I hadn't



seen him in about 15 years, and found him to be in the initial stages of dementia and Alzheimer's disease.

I gave my friend a letter that Mathias Maurer addressed to him, in German, and asked me to deliver, introducing himself as Halle's town Historian, and asking Dr. Braude to confirm the information that I had provided about the heroic role he had played in saving Halle from destruction by the 104th Division.

But instead of smiling, and saying "Sure -- here it is", my friend George Braude clammed up, saying that for all he knew, this Maurer guy might be part of today's underground Nazi party, and the SS might be coming to finally find and kill him and his family.

That's where the situation stood when I left for Europe in late 2002 and arrived in Halle to meet with Mathias Maurer, who was a magnificent host for me and my party. The father of Mathias Maurer, Siegfried Maurer, was a soldier in the

Wehrmacht (the “regular” German foot soldiers, not the SS elite forces -- Hitler’s personal bodyguards). He had been captured in North Africa by Americans and sent to a POW camp at Camp Carson, CO, where the 104th was in training for European duty.

As a prisoner of war, Siegfried Maurer was put to work doing many jobs that put him in touch with his guards, all members of the Timberwolves (I never drew such POW guard duty during my stint in Camp Carson, but I was aware that others in my battalion did).

This exposure to American GIs exposed Siegfried Maurer to the good side of Americans, and he proceeded to learn some English and to learn much about America that he admired and (according to his son Mathias) emulated the rest of his life after returning to his home town of Halle.

Shortly after the Americans took Halle, and after VE-Day (May 6, 1945) the geographic

region that included Halle was turned over to the Russians and became part of East Germany.

The Russians set up the East German educational system, and the new East German history texts taught that the Russians took Halle without razing it, not the Americans. That is the story that Mathias Maurer was taught as he was growing up.

But his father Siegfried advised him otherwise. “I know the 104th division took this town and did not raze it. The Russians are liars!”

As Halle’s Town Historian, Mathias Maurer wanted to write something to set the record straight for his people, now in the unified Germany, devoid of Russian influences and restrictions, and so the book he was writing told the true story of the Fall of Halle.

When we arrived in Halle, Mathias took 2-3 days guiding us through his beautiful town,

including a tour of the University of Halle (where Dr. Braude and one of the underground groups in Halle had been working during WW-II). He also showed us the headquarters of the “no surrender” SS commander, as well as the southern part of the town where the SS Hitler Jugend troops were holed up, but eventually surrendered.

Mathias also took us to his father’s home to meet his father, who was a delightful gentleman. He turned out to be few weeks older than I, and, like true valiant enemies-turned-allies, we shook hands and became friends.



Rip Rice (in red) meets Siegfried Maurer, Halle, Germany, 2002. The young man on the left is Mathias Maurer, Siegfried’s lawyer and Town Historian son.



Two former WW-II enemies, now friends and allies

## **A Tribute to the Teamwork That Saved Halle from Destruction**

Mathias advised me that the town of Halle had set aside a small corner house as a museum of sorts commemorating the efforts of Count von Luckner and his team and the 104th Infantry Division, as represented by Col. Gerald Kelleher (teamed with Col. Robert Clark) to avoid the town's destruction on April 18, 1945.

A plaque was erected in early 2002. When this museum was set up, there was no mention of Dr. George Braude and his part, not only as a member of Count Graf von Luckner's negotiating team, but also for his pots-and-

pans heroics of the night of April 18. However, Mathias Mauer promised that appropriate revisions would be made so that my friend would be recognized for his deeds that helped save the town of Halle.



“An historic place for the saving of the town of Halle”

Unhappily, George Braude lost his battle with Dementia and died in early 2003. He was incommunicable when Billie and I returned from our trip to Halle, but his wife was comforted to know that George was now known and being credited for his efforts.

## **On to Delitsch, Germany**

Having clarified the Braude role in Halle's history, Mathias Maurer took us on our last day to the town of Delitsch, about 20 miles east of Halle, near the Mulde River. This was the town where my last water point of the War had been installed and where we spent the last two weeks of the war. It was from Delitsch that some of our Timberwolves met some of the Russian soldiers at the Mulde River.

Delitsch was also the home of the oldest chocolate factory in Germany, and that building was taken over by General Terry Allen and his top staff.

Our water point was set up on the small town square (connecting to a fire hydrant as the water source). A short 1-2 block walk took me to a charming river with a marvelous view of a small island in the river center which was inhabited only by a very large tree, at the base of which was a series of wooden houses for ducks, geese and swans that populated the

river daily. I called it “the Delitsch swan house” because there were lots of swans that nested there at night.

Below are photos of that island, taken in April 1945 (b/w) from one side of the river, and again in late 2002, taken from the other side of the river. Nothing seems to have changed with the scene.



The Delitsch swan house, 1945



The Delitsch swan house, 2002



## **Dave Rice Stops Playing Trumpet**

The ravages of diabetes started taking their toll on David, and slowly, one by one, he was forced to give up his participation in the many musical groups in which he was a playing member. He reached the point that he could no longer play trumpet (fearing damage to his eyesight), and resigned from the Rockville Dixie Rascals. But two months later he returned to the Rascals with a banjo that he had bought and taught himself to play chords. So now, the Rascals added a new banjo player. What a dedicated guy!

And fortunately for him, he could continue playing tuba, since, believe it or not, playing tuba does not exert any strain on the eye muscles.

## **David Rice Passes**

Sadly, in July 2003, while Rip and Billie were cruising in Western Europe, came a phone call from their daughter-in-law Kathy that David had died suddenly at age 54. A massive heart

attack caused by complications from diabetes had taken him in an instant on July 3.

Rip and Billie's lives were changed forever, and soon thereafter, they made the decision, then the arrangements, to move into Brooke Grove Retirement Village, in late 2004.

### **The Rices Life at the Brooke Grove Retirement Village**

During construction of their cottage on "Pioneer Circle" (as Rip calls the Phase I circle of Hickory Knoll Road), Rip and Billie used to bring their dog, Jake, to see his new home. Jake was a mix of black Labrador plus Golden Retriever, just a gorgeous doggie, weighing a little over 70 lbs. When the cottages were almost ready for occupancy, the Rices received the "rules of occupation" that Brooke Grove Retirement Village had set down -- including "no pets weighing over 35 pounds".

What a shocker! Jake would have to lose 35 lbs! So the Rices went to Eileen Alexander and said that they were sorry, but they simply could not move into their cottage because for Jake to lose half his weight surely would distress him, to say the least.

But Eileen said she wanted to meet Jake (the Rices had been bringing him to see his new home, to show him his upstairs and downstairs rooms, etc., but he and Eileen had never met).

So we brought Jake out again, introduced him to Eileen, and she “fell in love with him” (Rip thinks Eileen is a pussy cat who loves all dogs).

“Of course Jake can move in with you two, and I will rewrite the regulation to allow admission for such perfect animals, no matter what their size and weight.” And so the initial 35-lb maximum weight rule for pets was changed to the present “as long as the pet is acceptable to management”, or words to that effect.

Unhappily, a couple of weeks before we received the ok to move in to our cottage, Jake had to be put to sleep -- some form of cancer was tearing him apart inside.

In Jake's memory, Billie and Rip offer the photograph below, which was taken about 2000.



Rip, Billie and Jake Rice

## **No Retirement for Rip**

Since Rip and Billie Rice have moved into their present Independent Living cottage, Rip has refused to accept “retirement” and giving up his ozone career. He is still consulting in ozone technologies and still traveling when necessary to attend ozone meetings and/or consult for clients.

Although Rip’s ozone career began with emphasis on water and wastewater treatment with ozone, the potentials of ozone to provide benefits in many other applications have developed, and that has led him to quickly become expert in those “new ozone” applications.

His latest two fields of concentration are Ozone for Commercial Laundry Systems -- for which he has coauthored *The Ozone Laundry Handbook* (2011) -- and Processing of Foods With Ozone, in which field he is one of four coeditors of the first text book on the subject,

*Ozone In Food Processing* (Wiley-Blackwell, Feb. 2012).

## **Music Activities**

Just after son David Rice died, and shortly before Rip and Billie made the decision to move into the Brooke Grove Retirement Village, Rip was coerced into joining the Olney Big Band to teach its members how to play big band swing music. Rip would much rather have just been a player within the band, but the desires of the band members to “learn how to swing” took precedence. So Rip moved out in front of the band and became its Music Director and Master of Ceremonies.

In the subsequent few years under Rip’s instruction, the Olney Big Band has progressed from a shaky dance band to a really good swing band that is in high demand today (2014).

The years 2007 and 2008 were something of a culmination for the OBB. Their first CD “*Generations*” was released in early 2007

and nearly 2,500 copies had been distributed through 2010. Several additional CDs and a DVD of one of the OBB's Olney Theatre Swing! Swing! Swing! concerts are now available as well.



Rip playing at BGRV with the Olney Big Band, June 17, 2007

In April 2008, the band played a concert at Washington, DC's Blues Alley, an east coast Mecca for jazz musicians. In July, 2008, the band traveled to Montreux, Switzerland, where they played two concerts at the world-famous Montreux Jazz Festival. And in early December 2008, the Band played at the Strathmore Arts Center, another Mecca for musicians of all types, in North Bethesda, Maryland.

In early 2011, the Olney Big Band gained another significantly important member. Dr. Robert Tennyson, former trombone player in musical groups of all types (including the Johnny Long big band during the latter part of the Big Band Era), and teacher of trombone and trumpet.

From 1994 to 2011, Dr. Tennyson spent 17 years of teaching and directing musical groups in Austria. One of these elite Austrian groups was the Big Band Tyrol, that under Dr. Tennyson's direction had become one of the premier big band jazz musical organizations in Europe.

Since early 2011, Bob Tennyson has been OBB's Music Director, and under his direction and guidance, the OBB now has moved another quantum step ahead.

Dr. Tennyson's joining the Olney Big Band has relegated Rip (voluntarily) to his more administrative, behind the scenes roles with the



band -- being Chairman of the OBB Board of Directors, and member of the editorial staff of *In The Mood*, the quarterly newsletter of the Olney Big Band (available by e-mail only).

At some concerts, Rip still is featured as the Band's Raconteur, introducing many musical numbers with interesting stories about those numbers played by the original big bands that made each one famous. Additionally, Rip plays Latin percussion instruments on some of the band's Latin charts, and on occasions (*When The Saints Go Marching In*), Rip may be found in front of the band playing his washboard.

### **Music Activities at Brooke Grove**

From 2005 through 2011, Rip played tenor sax every second and fourth Thursday mornings at volunteer piano player Lou Jones' Coffee Hours in the TLC room of the Brooke Grove Nursing Home & Rehabilitation Center.



Lou Jones --  
as fine a piano player as ever lived!

From the first time Rip heard Lou Jones play piano, he recognized Lou's ability to play the old-timey (big band era) tunes, to play stimulating solo choruses, and to be able to support a wind instrument with colorful piano backgrounds. Rip often says, "I'm glad Lou lets me play music with him. Little does he realize that I would pay HIM for that privilege!"

However, at age 88, hauling his sax, music, music stand, washboard, and special chair to the many gigs he was playing "stopped being fun." This is a statement he had read about for years from older musicians who had suddenly decided to stop playing. In his earlier days, Rip never could understand this attitude,

until it happened to him. Now he knows and understands.

## **Historian Activities**

In 2005, Rip became the ILRA Campus Historian and Photographer, and also is a member of the ILRA Program and Planning Committee and the Food Committee (of which he was Chairman in 2009-2010).

Rip was intrigued with becoming Campus Historian, and immediately set about writing an “orientation” booklet for new Brooke Grove Independent Living Residents, explaining some of the history of how the Brooke Grove Retirement Village evolved over time.

Although this BGRV history story is fascinating in and of itself, Rip really enjoys profiling the Independent Living residents who have made the decisions to move into this community. Rip had never done this sort of biographical writing before, but he has a knack for digging out stories of people’s lives and presenting them

in a manner that is interesting and informative. Read his Orientation Booklets (housed in the ILRA Library -- Westbrooke, basement, behind the Fitness Center), and you be the judge.

### **Sandy Spring History**

About mid-late 2009, a local Sandy Spring native (Delmas Wood) and Rip became close friends. Delmas Wood is a Sandy Spring history buff who, among other accomplishments, is the gentleman who founded the Sandy Spring Museum as well as the FDR Museum.

About a year later, Mr. Wood offered to feed Rip historical information about the Sandy Spring Neighborhood (an imaginary geographical circle drawn as a 6-mile radius from the Sandy Spring Friends Meeting House) if Rip would write “the book”. Delmas Wood convinced Rip that such a history book is needed and that Rip is the man to write it.

And so Rip has added a third arrow to his quiver -- that of a writer of local history.

However, accurately depicting historical events is not a rapid process, and Rip wants to be certain he has the facts correct, and that has slowed his progress somewhat.

At present, Rip is perhaps a year or two away from completing Volume One of “*A History of the Sandy Spring Neighborhood*”, which will describe the important historical events of this Neighborhood up through the Civil War. Volume Two will pick up the stories after the Civil War to the present day.

In the early stages of writing, Rip was introduced to Leonard Becraft, a Brookeville, Maryland resident who is also an historian and active in the Sandy Spring Museum. Leonard Becraft has joined the team of Rice and Wood, and the three are moving ahead to complete Volume One (hopefully in 2015 or 2016).

### **History Lectures**

Recognizing the time it will take to complete even Volume One of *A History of the Sandy*

*Spring Neighborhood*, Rip decided to prepare a series of lectures based on chapters as they are drafted and to present these lectures to the Brooke Grove Independent Living residents. This lecture series began in February, 2011 and most lectures are supplemented with field trips to historical sites in the area that are the subjects of the lectures. These lectures have been well received, and the Sandy Spring Museum has been in touch with Rip and Delmas Wood about developing these lectures for public presentation in the future.

### **As We Enter 2014**

So there we have Rip Rice -- Consultant in Ozone Technologies, Musician, History Writer and Lecturer -- still quite active at almost 90 years. Rip says, "As long as the Good Lord keeps me in good health and of sound mind, and as long as wife Billie can tolerate me, I plan to continue doing what I have been doing."

## **Business Travel (Ozone)**

Rip normally invites Billie along on ozone business trips, especially when they involve overseas travel. For example, in May 2011, Rip and Billie spent a week in Paris, France at a World Congress of the International Ozone Association, where Rip gave three papers on Ozone Laundry Systems and one on Ozone For Food Processing. Then, off they flew to Rome to pick up a 7-day cruise of the Eastern Mediterranean Ocean before returning home.

## **Retirement?**

When asked about when he will retire, Rip usually says, “Not me! Retirement is for those who don’t like what they are doing. Me? I LOVE what I am doing!” He plans to “retire” when his toes turn up, and no sooner, barring physical incapacitation.

R.G. Rice, February 23, 2014

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# Converting Ozone

"Oxygen" Ozone Concentration at Variable Standard Temperatures

Parameter	Units	Case 5	Case 6	Case 7	Case 8
Oxygen Feed Gas Density	g/L <sub>25</sub>	1.4243	1.4243	1.4243	1.4243
Standard Temperature	°C	0	0	0	0
Molar Volume	L/mol	22.411	22.411	22.411	22.411
Ozone G/MV	g/mol	48	48	48	48
Ozone Density	mg/L <sub>25</sub>	2141.8	2141.8	2141.8	2141.8
Ozone Concentration	%wt	6	6	10	12
	mg/L <sub>25</sub> / %wt	87.20	107.26	147.20	178.32
	%wt	4.37	5.47	6.98	8.37
	ppm	43,712	54,854	68,767	83,716
	ppm	80,000	80,000	100,000	120,000
	mg/L <sub>25</sub> / %wt	14.53	14.53	14.73	14.85
Parameter	Units	Case 13	Case 14	Case 15	Case 16
Oxygen Feed Gas Density	g/L <sub>25</sub>	1.3071	1.3071	1.3071	1.3071
Standard Temperature	°F	68	68	68	68
Molar Volume	L/mol	24.452	24.452	24.452	24.452
Ozone G/MV	g/mol	48	48	48	48
Ozone Density	mg/L <sub>25</sub>	1085.7	1085.7	1085.7	1085.7
Ozone Concentration	%wt	6	6	10	12
	mg/L <sub>25</sub> / %wt	81.25	105.07	107.27	166.67
	%wt	4.37	5.47	6.98	8.37
	ppm	40,711	54,853	68,766	83,715
	ppm	80,000	80,000	100,000	120,000
	mg/L <sub>25</sub> / %wt	13.94	13.93	13.73	13.92



"Air" Ozone Concentration at Variable Standard Temperatures

Parameter	Units	Case 1	Case 2	Case 3	Case 4
Air Feed Gas Density	g/L <sub>gas</sub>	1.2502	1.2502	1.2502	1.2502
Standard Temperature	C	0	0	0	0
Molar Volume	L <sub>gas</sub>	32.471	32.471	32.471	32.471
Ozone Dilution	g/mol	48	48	48	48
Ozone Density	mg/L <sub>gas</sub>	2747.5	2747.5	2747.5	2747.5
Ozone Concentration	%wt	8.5	1	2	1.5
	mg/L <sub>gas</sub>	6.47	12.96	25.30	32.55
	%vol	0.30	0.49	1.29	1.32
	ppm	3.021	6.351	12.140	15.198
	ppm	5.000	10.000	20.000	25.000
	mg/L <sub>gas</sub> /Std	13.94	12.96	13.90	13.92
Parameter	Units	Case 5	Case 6	Case 7	Case 8
Air Feed Gas Density	g/L <sub>gas</sub>	1.2504	1.2571	1.242	1.257
Standard Temperature	F	59	89	59	89
Molar Volume	L <sub>gas</sub>	24.052	24.052	24.052	24.052
Ozone Dilution	g/mol	48	48	48	48
Ozone Density	mg/L <sub>gas</sub>	1935.7	1935.7	1935.7	1935.7
Ozone Concentration	%wt	8.5	1	2	1.5
	mg/L <sub>gas</sub>	6.03	13.32	27.02	32.71
	%vol	0.30	0.57	1.36	1.69
	ppm	3.021	6.672	13.540	16.609
	ppm	5.000	10.000	20.000	25.000
	mg/L <sub>gas</sub> /Std	12.06	13.32	13.31	13.48

Equation used to convert from **mg/L** to **%wt** (NTP<sub>0c</sub>)

$$Y_1 = \frac{1000 W_g Y_1'}{100 - \frac{0.5 W_g Y_1' V_m}{GMW_{O_3}}}$$

Equation used to convert from **%wt** to **mg/L**.

$$Y_1' = \frac{100 Y_1}{W_g \left( 1000 + \frac{0.5 Y_1 V_m}{GMW_{O_3}} \right)}$$

Where:

$Y_1'$  = Ozone concentration, percent by weight (NOTE: 1%wt means 1-lb ozone per 100-lb gas, or 0.01 lb/lb)

$Y_1$  = Ozone concentration, mg/L

100 = Conversion of mass ratio to percent expression

$V_m$  = Molar volume (22.411 L/mol.)

$GMW_{O_3}$  = Gram molecular weight of ozone, g/mol.

$W_{fg}$  = Density of feed gas, g/L

Equation converts from **mg/L** to **%vol**. The maximum concentration, in mg/L, is determined assuming that the ozone concentration is 100 %vol.

$$Y_1'' = \frac{Y_1}{Y_{1-\max}} \times 100$$

Where:

$Y_1''$  = Ozone concentration, percent by volume (NOTE: 1%vol means 1-ft<sup>3</sup> ozone per 100-ft<sup>3</sup> gas, or 0.01 ft<sup>3</sup>/ ft<sup>3</sup>)

$Y_1$  = Ozone concentration, mg/L<sub>NTP</sub> or mg/L<sub>STP</sub>

$Y_{1-\max}$  = Maximum ozone concentration (density), mg/L, at 100 %vol ozone is 2,141.8 mg/L at NTP<sub>0C</sub> and 1,995.7 at STP<sub>68F</sub>

Density of Various Feed Gas Systems, NTP @ 0.1"					
Parameter	Units	Air <sup>1</sup>	Oxygen <sup>2</sup>	Argon <sup>3</sup>	USA av. MP5-g <sup>4</sup>
Oxygen	%volume	20.541	98	95	92
Nitrogen	%volume	78.122	2	1	4
Argon	%volume	0.937		4	4
Molecular Weight	g/mol	28.9538	31.9203	39.9781	32.1585
Density	g/LNTP	1.2932	1.4243	1.4903	1.4349
Density	lb/ft <sup>3</sup> NTP	0.08067	0.08892	0.09392	0.08958
Density of 100% Pure Gas, NTP @ 0.1"					
Parameter	Units	Oxygen	Nitrogen	Argon	Ozone
Gram Molecular Wt.	g/mol	32	28.013	39.95	48
Density	g/LNTP	1.426	1.25	1.763	2.142
	lb/ft <sup>3</sup> NTP	0.0891	0.078	0.1113	0.1337
Constants and Conversion Factors					
Volume at NTP		22.411	liters @ 0.1"		
Constant		453.592	g/lb		
Constant		28.317	lb/ft <sup>3</sup>		
1. Air feed-gas 2. Oxygen feed-gas with supplemental nitrogen addition. 3. Pressure swing adsorption on-site oxygen concentration system. 4. Vacuum swing adsorption on-site oxygen concentration system (vacuum-pressure swing adsorption)					

Density of Various Feed-Loss Streams: STP @ 68 °F					
Parameter	Units	Ag <sup>1</sup>	Percent <sup>2</sup>	PSA <sup>3</sup>	YSM or MDS <sup>4</sup>
Oxygen	%volume	20.941	98	95	92
Nitrogen	%volume	78.122	2	1	4
Argon	%volume	0.937		4	4
Molecular Weight	g/mol	28.9598	31.9203	32.2701	32.1585
Density	g/L STP	1.204	1.3271	1.342	1.337
Density	lb/ft <sup>3</sup> STP	0.07516	0.08285	0.08378	0.083467
Density of 100% Pure Gas: STP @ 68 °F					
Parameter	Units	Oxygen	Nitrogen	Argon	Ozone
Molecular Weight	g/mol	32	28.013	39.95	48
Density	g/L STP	1.33	1.165	1.661	1.996
Density	lb/ft <sup>3</sup> STP	0.083	0.0727	0.1037	0.1246
Constants and Conversion Factors					
Volume at STP	24.052	1.361	1.361		
Constant	453.592	g/lb			
Constant	28.317	lb/ft <sup>3</sup>			
1. Air feed-gas 2. Oxygen feed-gas with supplemental nitrogen addition. 3. Pressure swing adsorption on-site oxygen concentration system. 4. Vacuum swing adsorption on-site oxygen concentration system (vacuum-pressure swing adsorption)					

# SUMMARY of CONSTANTS for ALL CALCULATIONS

Standard Temperature	32	F
	0	C
Standard Pressure	34.786	psi
	760	mm Hg
	101,300	Pa
	101.3	kPa
	3,116.2	psf
	30.48	ft water
	10.33	m water
	1,033.2	cm water
Absolute Temperature	489.7	R
	273.15	K
Constant	6,2778	Wt%/L
Energy for oxygen splitting	284.3	kJ/mole ozone 3O2 = 2O3
Mass in one mole	6.0047	lb
	6.3734	kgm/lb
Gas Volume at Absolute Temp.	22.411	L/mole
Water volume Constant	6.002048	L/mole H2O
	22.411	L/mole
Universal Gas Constant (R)	1,545.4	ft lb/mole R
Constant	30,000	ft lb/min/HP
Constant	31.9	ft H2O/cm
Constant	3,432	BTU/lbm
Constant	43,840	ft <sup>3</sup> /2/acre
Specific Heat of Air	0.241	BTU/lb-F
Specific Heat of Oxygen	0.219	
Constant	0.744	km/hp
Constant	1,400	gpm x ft H2O per HP
Specific Heat of Water	1.0	BTU/lb-deg F
Weight of Water	1.0	g/ml
Weight of Water	8.3455	lb/gal
Oxygen Weight	9.52	lbO2/lbGal
Heat of Vaporization	970	BTU/lb
Theoretical SE for Ozone Production	0.212	kwh/lb
Specific heat of water	1.0	BTU/lb-deg F
CONVERSION FACTOR	2.308	ft water/28
CONVERSION FACTOR	27.684	in water/gal
CONVERSION FACTOR	0.744	km/hp
GHW of Oxygen	32.0000	g/mole
	1.4278	g/L
	0.0891	lb/ft <sup>3</sup>
GHW of Nitrogen	28.0134	g/mole
	1.2500	g/L
	0.0780	lb/ft <sup>3</sup>
GHW of Argon	39.9480	g/mole
	1.7825	g/L
	0.1113	lb/ft <sup>3</sup>
GHW of Ozone	47.9982	g/mole
	2.1417	g/L
	0.1337	lb/ft <sup>3</sup>
GHW of Water	18.0152	g/mole
CONVERSION FACTOR	2.4289	m <sup>3</sup> /min/mgd
" "	167.1043	m <sup>3</sup> /hr/mgd
" "	6.3096	m <sup>3</sup> /h
" "	2.74	cm <sup>3</sup> /s
" "	6.0283168	m <sup>3</sup> /ft <sup>3</sup>
" "	28.3168	L/m <sup>3</sup>
" "	453.592	g/lb
" "	52.811	lb/day / kg/hr
" "	3.785	L/gal
" "	1.4813	gal/ft <sup>3</sup>
" "	2.42	lb/ft <sup>3</sup> /centipoise
" "	62.428	lbw/ft <sup>3</sup>
Gravitational Constant	6.6738*10 <sup>-8</sup>	
Constant	12,000	BTU/hr per ton
Constant	365	days / year

**Table 6-1. Summary of Important Measured Ozone Parameters**

Parameter	Symbol	Units	Equation	Comment
Feed-gas flow	$G_1$	scfm (ft <sup>3</sup> /min) or Nm <sup>3</sup> /hr	Measured	Flow of feed gas into the ozone generator. This measurement is used to calculate ozone production, parameters that are based on ozone production and size of ozone destruct facilities.
Product-gas flow	$G_2$	scfm (ft <sup>3</sup> /min) or Nm <sup>3</sup> /hr	Measured	Flow of ozone product gas from the ozone generators. This measurement is used to monitor and control the gas flow rate to individual ozone contactors in order to obtain balanced disinfection performance from parallel contactor units.
Product-gas ozone concentration	$Y_1$	%wt or g/Nm <sup>3</sup>	Measured	Ozone concentration in the product-gas from the ozone generator. This measurement is used to calculate ozone production, plus other parameters that are based on ozone production.
Off-gas ozone concentration	$Y_2$	%wt or g/Nm <sup>3</sup>	Measured	Ozone concentration in the off-gas from the ozone contactor. This measurement is used to calculate ozone transfer efficiency, which is an assessment of the capability of the diffusion system (e.g., diffusers) to transfer ozone into the water.
Vent-gas ozone concentration	$Y_3$	ppm <sub>v</sub>	Measured	Ozone concentration in the vent-gas from the ozone contactor. This measurement is used to monitor the discharge of ozone into the atmosphere, which might be a regulatory requirement. The reading is also used to assess the efficiency of the ozone destruction process.
Power Demand	$P_w$	kW	Measured	Power demand of the ozone generator. This measurement is used to assess the efficiency of the ozone generator, which is measured as specific energy (kWh/lb or kWh/kg).
Water flow	L	MGD or MLD	Measured	Water flow rate through the ozone contactor. This measurement is used to determine the applied ozone dosage, and other parameters that are based on applied ozone dosage.
scfm = Standard cubic feet per minute Nm <sup>3</sup> /hr = Normal cubic meters per hour %wt = Percent ozone concentration by weight g/Nm <sup>3</sup> = Grams ozone per Normal cubic meter ppm <sub>v</sub> = Part per million by volume kW = kilowatt MGD = Million gallons per day MLD = Million Liters per day, or mega Liters per day				

**Table 6-2. Summary of Important Calculated Ozone Parameters**

Parameter	Symbol	Units	Equation	Comment
Ozone production	P	lb/day or kg/day	a) $P = G_1 \times Y_1$ b) $P = G_2 \times Y_1$	Ozone production is the mass flow of ozone from the generators. a) Gas flow, $G_1$ , is converted to mass flow (lb/day or kg/day) and is multiplied by ozone concentration (%wt). b) Gas flow, $G_2$ , is expressed as volumetric flow (Nm <sup>3</sup> /hr) and is multiplied by ozone concentration (g/Nm <sup>3</sup> ).
Applied ozone dose	D	mg/L	$D = \frac{P}{L}$	Applied ozone dose is the ozone feed rate per unit volume of water, similar to dosage of other chemicals in the water treatment plant, such as chlorine.
Transfer efficiency	TE	%	Concentration-based $TE = \frac{(Y_1 - Y_2)}{Y_1} \times 100$  Mass-based $TE = \frac{(G_2 \times Y_1 - G_3 \times Y_2)}{G_2 \times Y_1} \times 100$  Where $G_3$ is the off-gas flow rate, which is typically not measured.	Concentration-based transfer efficiency is an easily determined estimation of the percentage of ozone that is transferred to the water.  A more involved, but accurate determination of transfer efficiency includes gas flow, since gas flow might be lost (or gained) through the contactor. <i>NOTE: In full-scale ozone applications it is difficult, impractical and unnecessary to measure off-gas flow and accurately calculate ozone TE. The concentration-based TE can be used to effectively monitor changes in dissolution performance due to equipment malfunction, such as failure of diffuser gaskets.</i>
Transferred ozone dose	T	mg/L	$T = D \times TE$	Transferred ozone dose is the quantity of applied ozone dose that has not escaped in the off-gas.
Specific energy	SE	kWh/lb or kWh/kg	$SE = \frac{P}{P} \times 24 \text{ hr/day}$	Specific energy is a measure of the performance or efficiency of the ozone generator. Generator design features, operating pressure, ozone concentration, and cooling water temperature influence specific energy.
lb/day = pounds of ozone per day kg/day = kilograms of ozone per day mg/L = milligrams per Liter kWh/lb = kilowatt-hours per pound kWh/kg = kilowatt-hours per kilogram				



**Table 6-3. Standard/Normal Pressure and Absolute Temperature**

Standard/Normal Pressure	1.0 Atmosphere
	14.696 psi
	760 mm Hg
	101,325 Pa
	101.325 kPa
	2,116.2 psft
	33.90 ft water
	10.332 m water
	1,033.2 cm water
Absolute Temperature	459.7 R
	273.15 K

**Table 6-4. Parameters for Determining Gas Density at NTP<sub>0c</sub>**

<b>Density of Various Feed -gas Systems, NTP @ 0 °C</b>					
Parameter	Units	Air <sup>1</sup>	Oxygen <sup>2</sup>	PSA <sup>3</sup>	VSA or VPSPA <sup>4</sup>
Oxygen	%volume	20.941	98	95	92
Nitrogen	%volume	78.122	2	1	4
Argon	%volume	0.937	0	4	4
Molecular Weight	g/mol	28.9598	31.9203	32.2781	32.1585
Density	g/LNTP	1.2922	1.4243	1.4403	1.4349
Density	lb/ft <sup>3</sup> NTP	0.08067	0.08892	0.08992	0.08958
<b>Density of 100% Pure Gas, NTP @ 0 °C</b>					
Parameter	Units	Oxygen	Nitrogen	Argon	Ozone
Gram Molecular Wt.	g/mol	32	28.013	39.95	48
Density	g/LNTP	1.428	1.25	1.783	2.142
	lb/ft <sup>3</sup> NTP	0.0891	0.078	0.1113	0.1337
<b>Constants and Conversion Factors</b>					
Volume at NTP	22.411	L/mol @ 0°C			
Constant	453.592	g/lb			
Constant	28.317	L/ft <sup>3</sup>			
1. Air feed-gas					
2. Oxygen feed-gas with supplemental nitrogen addition.					
3. Pressure swing adsorption on-site oxygen concentration system.					
4. Vacuum swing adsorption on-site oxygen concentration system (vacuum-pressure swing adsorption)					

**Table 6-5. Parameters for Determining Gas Density at STP<sub>68F</sub>**

<b>Density of Various Feed -gas Systems, STP @ 68 °F</b>					
Parameter	Units	Air <sup>1</sup>	Oxygen <sup>2</sup>	PSA <sup>3</sup>	VSA or VPSA <sup>4</sup>
Oxygen	%volume	20.941	98	95	92
Nitrogen	%volume	78.122	2	1	4
Argon	%volume	0.937		4	4
Molecular Weight	g/mol	28.9598	31.9203	32.2781	32.1585
Density	g/LSTP	1.204	1.3271	1.342	1.337
Density	lb/ft <sup>3</sup> STP	0.07516	0.08285	0.08378	0.08347
<b>Density of 100% Pure Gas, STP @ 68 °F</b>					
Parameter	Units	Oxygen	Nitrogen	Argon	Ozone
Molecular Weight	g/mol	32	28.013	39.95	48
Density	g/LSTP	1.33	1.165	1.661	1.996
Density	lb/ft <sup>3</sup> STP	0.083	0.0727	0.1037	0.1246
<b>Constants and Conversion Factors</b>					
Volume at STP	24.052	L/mol @ 68°F			
Constant	453.592	g/lb			
Constant	28.317	L/ft <sup>3</sup>			
1. Air feed-gas					
2. Oxygen feed-gas with supplemental nitrogen addition.					
3. Pressure swing adsorption on-site oxygen concentration system.					
4. Vacuum swing adsorption on-site oxygen concentration system (vacuum-pressure swing adsorption)					

**Table 6-6. Ozone Concentration Conversion Factors at NTP<sub>0C</sub>**

<b>AIR feed-gas at Normal Temperature and Pressure (NTP = 0 °C and 1 atmosphere)</b>					
Parameter	Units	Concentration 0.5 %wt	Concentration 1.0 %wt	Concentration 2.0 %wt	Concentration 2.5 %wt
Air Feed Gas Density	g/L <sub>NTP</sub>	1.2922	1.2922	1.2922	1.2922
Molar Volume	L <sub>NTP</sub>	22.411	22.411	22.411	22.411
Ozone GMW	g/mol	48	48	48	48
Ozone Density @ 100%vol	mg/L <sub>NTP</sub>	2,141.8	2,141.8	2,141.8	2,141.8
Ozone Concentration	%wt	0.5	1.0	2.0	2.5
Ozone Concentration	mg/L <sub>NTP</sub>	6.47	12.96	26.00	32.55
Ozone Concentration	%vol	0.30	0.61	1.21	1.52
Ozone Concentration	ppm <sub>v</sub>	3,021	6,051	12,140	15,198
Ozone Concentration	ppm <sub>w</sub>	5,000	10,000	20,000	25,000
Ozone Concentration	mg/L <sub>NTP</sub> / %wt	12.94	12.96	13.00	13.02

<b>OXYGEN feed-gas at Normal Temperature and Pressure (NTP = 0 °C and 1 atmosphere)</b>					
Parameter	Units	Concentration 6.0 %wt	Concentration 8.0 %wt	Concentration 10.0 %wt	Concentration 12.0 %wt
Oxygen Feed Gas Density	g/L <sub>NTP</sub>	1.4243	1.4243	1.4243	1.4243
Molar Volume	L <sub>NTP</sub>	22.411	22.411	22.411	22.411
Ozone GMW	g/mol	48	48	48	48
Ozone Density @ 100%vol	mg/L <sub>NTP</sub>	2141.8	2141.8	2141.8	2141.8
Ozone Concentration	%wt	6	8	10	12
Ozone Concentration	mg/L <sub>NTP</sub>	87.20	117.06	147.33	178.02
Ozone Concentration	%vol	4.07	5.47	6.88	8.31
Ozone Concentration	ppm <sub>v</sub>	40,712	54,654	68,787	83,116
Ozone Concentration	ppm <sub>w</sub>	60,000	80,000	100,000	120,000
Ozone Concentration	mg/L <sub>NTP</sub> / %wt	14.53	14.63	14.73	14.83

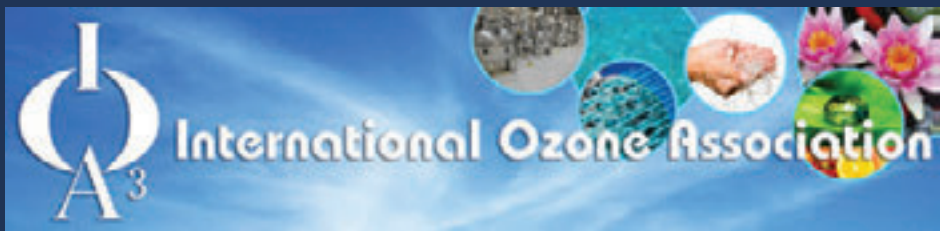
**Table 6-7. Ozone Concentration Conversion Factors at STP<sub>68F</sub> or 20°C**

<b>AIR feed-gas at Standard Temperature and Pressure (STP = 20 °C and 1 atmosphere)</b>					
Parameter	Units	Concentration 0.5 %wt	Concentration 1.0 %wt	Concentration 2.0 %wt	Concentration 2.5 %wt
Air Feed Gas Density	g/L <sub>STP</sub>	1.204	1.204	1.204	1.204
Molar Volume	L <sub>STP</sub>	24.052	24.052	24.052	24.052
Ozone GMW	g/mol	48	48	48	48
Ozone Density @ 100%vol	mg/L <sub>STP</sub>	1995.7	1995.7	1995.7	1995.7
Ozone Concentration	%wt	0.5	1	2	2.5
Ozone Concentration	mg/L <sub>STP</sub>	6.03	12.08	24.23	30.33
Ozone Concentration	%vol	0.30	0.61	1.21	1.52
Ozone Concentration	ppm <sub>v</sub>	3,021	6,051	12,139	15,197
Ozone Concentration	ppm <sub>w</sub>	5,000	10,000	20,000	25,000
Ozone Concentration	mg/L <sub>STP</sub> / %wt	12.06	12.08	12.11	12.13

<b>OXYGEN feed-gas at Standard Temperature and Pressure (STP = 20 °C and 1 atmosphere)</b>					
Parameter	Units	Concentration 6.0 %wt	Concentration 8.0 %wt	Concentration 10.0 %wt	Concentration 12.0 %wt
Oxygen Feed Gas Density	g/L <sub>STP</sub>	1.3271	1.3271	1.3271	1.3271
Molar Volume	L <sub>STP</sub>	24.052	24.052	24.052	24.052
Ozone GMW	g/mol	48	48	48	48
Ozone Density @ 100%vol	mg/L <sub>STP</sub>	1995.7	1995.7	1995.7	1995.7
Ozone Concentration	%wt	6	8	10	12
Ozone Concentration	mg/L <sub>STP</sub>	81.25	109.07	137.27	165.87
Ozone Concentration	%vol	4.07	5.47	6.88	8.31
Ozone Concentration	ppm <sub>v</sub>	40,711	54,653	68,786	83,115
Ozone Concentration	ppm <sub>w</sub>	60,000	80,000	100,000	120,000
Ozone Concentration	mg/L <sub>STP</sub> / %wt	13.54	13.63	13.73	13.82

Ozone conversion information is from Kerwin Rakness data files, some of which was source information for the published “AWWA Ozone Book” titled: Ozone in *Drinking Water Treatment, Design, Operation and Optimization*, 2005.



# The Father of Ozone

It is with heartfelt respect and gratitude that we recognize the incredible impact that Dr. Rip Rice had, not only on the ozone industry, but also on the entire world around him. Rip is often referred to as the “Father of ozone” because of his groundbreaking work in bringing the “gospel of ozone” to the federal government.

Rip was instrumental in forming the International Ozone Association - whose mission would be to gather and disseminate information about the manufacture, application and uses of ozone.



Rip was an accomplished musician and you could often find Rip, at various ozone trade shows, performing on stage.

On June 3rd, 2015, Rip passed away. This is his story in his words.

Rip pictured with his wife, Billie, and their dog, Jake.