



**Pollution Prevention
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Replacing Ozone-Depleting Chemicals: Taxes and Decisions for a Manufacturer

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Background on Ozone Destruction and Chlorofluorocarbons (CFCs)

On September 16, 1987, the United States signed the Montreal Protocol agreeing to reduce the production of chlorofluorocarbons (CFCs) within its borders to as little as 50% of 1986 benchmark levels by 1998. The treaty came about following years of scientific investigation into the effects of CFCs on upper atmospheric chemistry. After much debate and considerable opposition from vested interests, it had been accepted by an overwhelming portion of the scientific community that CFCs were destroying large quantities of ozone in the stratosphere. Government leaders, bowing to these findings as well as the public's health concerns, acted to reduce CFC production in what was the first global ecological treaty in the history of the world.

Ozone in the upper atmosphere, chemically O₃, absorbs harmful ultraviolet (UV) radiation preventing it from striking the surface of the earth. UV radiation can break down DNA structure in all living things. For humans, excessive exposure to ultraviolet radiation has been implicated in increased incidences of skin cancer and cataracts. Prior to the creation of the ozone layer some two billion years ago, life as we know it was not possible largely because of the constant bombardment of UV radiation.

In the process of absorbing ultraviolet radiation, the O₃ molecule is broken apart. Replacement ozone is created on the surface of the earth, eventually reaching the stratosphere. While there have undoubtedly been fluctuations in ozone concentration, those fluctuations have been within a narrow band. CFCs, discovered by Thomas Midgley in 1928, were at first thought to be inert gases because they did not break down in the lower atmosphere.¹ In the 1970s it was discovered that CFCs drifted into the upper atmosphere where ultraviolet radiation split them apart, releasing chlorine atoms. Chlorine is a catalyst entering into a chemical reaction with ozone, breaking the O₃ molecule apart and creating oxygen.² Each chlorine atom can enter into this process many times over during the course of as many as 50 to 100 years before it falls to the surface of the earth. The delicate balance between ozone molecules and UV radiation was clearly in danger of major disruption.

CFCs have been used in refrigerants, styrofoam and many other processes including cleaning computer chips. One of the more ubiquitous uses for CFCs in the past was as propellants in aerosol spray cans. By 1973, spray cans accounted for 75% of all CFC emissions in the U.S.³ In 1978, the federal government, acknowledging the danger of CFC destruction to the ozone layer, enacted legislation banning CFC use in aerosols.⁴

Ironically, in December 1987, shortly after the Montreal Protocols were signed, a hole in the ozone layer above Antarctica was discovered. It confirmed the worst predictions scientists had been making for some time.

In 1989, the Revenue Reconciliation Act put in place taxes making the sale and use of CFCs increasingly expensive prior to their being phased out as an incentive to manufacturers to develop alternatives. The Clean Air Act codified the complete phaseout of production, with 1996 as the initial target date complying with the 1992 revision of the Montreal Protocols. Major manufacturers such as DuPont, sensing growing public unease, accelerated the complete phaseout target date to 1994.

The Case at Panazoic Chemical Company

On October 1, 1990, Albert Pana, president of Panazoic Chemical Company (PCC), a diversified chemical manufacturer, was trying to decide what to do about the tax on Ozone Depleting Chemicals (ODCs). PCC had an inventory of 2,000,000 pounds of the ODC Halon-1211. According to the new tax, these substances are subject to a tax rate dependent on an ozone-depleting factor. The tax per pound was scheduled to increase periodically (see Table 1).⁵ Halon has been assigned an ozone-depleting factor of 3.0, considerably higher than the 1.0 factor given to common household refrigerants. Determining the tax due involves multiplying the ODC factor by the tax rate and then multiplying that product by the number of pounds in stock or quantity sold.

A grandfather clause in the tax bill allowed firms to delay direct manufacturing taxes on goods produced until their sale if the ODCs were mixed prior to 1/1/90. Anticipating the new tax, PCC made large quantities of Halon-1211 prior to 1/1/90. One decision for PCC to make was whether to elect to pay the tax on its inventory as of 1/1/91, or to pay tax as the Halon is sold. If it elected to pay a floor tax on inventory in stock as

of 1/1/91, PCC would also have to pay additional floor taxes based on the incremental tax change each January 1st multiplied by the ODC factor and the number of pounds on hand.

Panazoic currently expected to sell 35,000 pounds of Halon per month — until stock ran out or a substitute was developed — at \$10 per pound, substantially above the \$3 cost of manufacturing the chemical. That cost would be expensed as each pound was sold in the future. The only other variable cost associated with Halon was two cents/pound/month for storage.

Albert asked Dorothy Ross, the firm's financial analyst, to assist him in the decision-making.

"As you know Dorothy," said Albert, "we have two million pounds of Halon-1211 in stock. We can elect to pay the tax January 1 or pay it pound for pound as we sell the Halon. Of course, we know that Pacific Chemical is working on an alternative chemical that has a 20% probability of hitting the market by January 1, 1992, a 50% chance of being out by January 1, 1993 and a 75% chance of being on the market by January 1, 1994. We are virtually certain it will be out by January 1, 1995. With that sort of timetable, the ban on Halon manufacturing slated to go into effect in 1996 will be moot. Given our sales projections, we won't be manufacturing any more of it.

"Once Pacific's new chemical is out, whatever Halon we've got left will be worthless. Actually, it will be less than worthless. We'll need to pay to dispose of it properly. From our sales figures of the last three years, can you give us an idea of how we should pay the tax?"

Dorothy was concerned with other factors as she left Albert's office. Paying the lower tax rate January 1 rather than as the chemical was sold had some risks. If Pacific brought its new product to market, PCC would have paid the tax on goods it would no longer be able to sell and would, in fact, have to pay for disposal. Disposing of Halon today, if it came to that, would cost PCC 50 cents per pound, at least until January 1, 1991. That cost could be expected to rise by 20% per year. Partially offsetting the disposal costs would be PCC's ability to write off the \$3/pound manufacturing cost.

With few firms making Halon and PCC sitting on a considerable stockpile, there was the possibility of making windfall profits as the January 1, 1996, date approached. PCC anticipated prices would rise

sufficiently to more than cover the additional tax burden, perhaps even overcoming the risk of Pacific's new entrant killing future sales somewhere down the road.

Dorothy believed that PCC could institute a 25% price hike effective January 1, 1991. She expected the market for Halon to rise steadily, perhaps at a rate of about 3% per month after January 1, 1991.

From prior conversations with Albert, Dorothy was also aware of another option. Panazoic could sell all of its Halon to the James Fire Extinguisher Company. James had offered to pay \$10 million, half the current price per pound. The sale, as long as it was completed prior to January 1, 1991, would be exempt from ODC taxes, although it would be subject to PCC's corporate tax rate of 35%.

PCC uses a 12% cost of capital. For this analysis, Dorothy intended to apply a 1% monthly discount rate. Using monthly discounting seems more appropriate due to the monthly price change in January and expected month-to-month upward price movements thereafter.

A Legal Wrinkle

Ted Siegel, PCC's chief attorney, raised an entirely different issue with Dorothy: the possibility of all ODC manufacturers being the target of a major class action suit. Several studies had shown that declines in the ozone content of the stratosphere were directly correlated with increased cases of skin cancer. Many of the chemicals, including Halon, would continue to destroy ozone for up to 100 years after being released to the atmosphere.

"Some smart lawyer or two could get together with a sharp financial analyst and figure out how many cases of skin cancer were caused by each million pounds of ODC released over the last 50 years," said Ted. "Every company that's produced the stuff has records of what they sold. By targeting the handful of major manufacturers in the business, an argument could be made that responsible parties should pay into a fund that would later be used to compensate victims.

"What's more, the government has already established the ozone-depleting danger of each of these chemicals within the tax code. Anybody selling it now is doing it knowing its potential health risk to humans."

While Ted was by no means certain that such a suit would ever hold up in court, it had the potential to tie up PCC's legal staff. Dorothy was not about to attempt to calculate the cost of such a legal action or even to contemplate its likelihood. However, she intended to keep it in mind when she took a look at the financial benefits of continuing to sell Halon versus selling PCC's entire stock to James.

Table 1

Excise Tax Per Pound of ODC Manufactured or Sold

1990	\$1.37
1991	\$1.37
1992	\$1.67
1993	\$2.65
1994	\$2.65
1995–	the tax increases by 45 cents each year

Endnotes

- ¹ Gribbin, John, *The Hole in the Sky*, 1988, Bantam Books, N.Y.
- ² Firor, John, *The Changing Atmosphere: A Global Challenge*, Yale University Press, 1990.
- ³ Dotto, Lydia and Harold Schiff, *The Ozone War*, 1978, Doubleday & Co., Garden City, NY.
- ⁴ Gribbin, John, *The Hole in the Sky*, 1988, Bantam Books, N.Y.
- ⁵ Rocen, Donald T. and David C. Green, "New Tax on Ozone-Depleting Chemicals Has Far-Reaching Consequences," *The Journal of Taxation*, May 1990, 282–285.

Guidance Questions

1. Set up a decision tree with each of the possibilities and financial outcomes attached to annual branches. Determine what the joint probabilities are for cessation of production as of each possible date Pacific may introduce its new chemical. Calculate the after tax present value cash flows after storage costs and ODC taxes (as of October 1, 1990) on a year-by-year basis. Do your annual calculations two ways; with and without the inclusion of disposal costs for each year Pacific has any possibility of bringing its new product to market. Note: ODC excise taxes are a deductible expense. Recall also that production costs were incurred prior to this analysis when calculating cash flow.
2. What is the expected present value of cash flows if all taxes are paid January 1, 1991 versus ODC tax payments as Halon is sold? In doing this calculation be sure to take into account the joint probabilities of Pacific's new product entering the market at various possible dates any of which would immediately end PCC's Halon sales. Don't forget to include disposal costs of Halon in stock at the time Pacific enters the market and take a tax writeoff for leftover Halon inventory.
3. What is the maximum present value cash flow the company might realize? What is the minimum present value cash flow?
4. What cash flow will PCC realize from an immediate sale of all Halon stock to James Fire Extinguisher Company?
5. Discuss the possibility of a class action suit against PCC and other ODC manufacturers.
6. Considering the results of your analysis, should PCC sell its Halon to James Fire Extinguisher Company for \$5 million?
7. Aside from financial implications, is it ethical to continue selling a product that is very likely damaging the environment?