This was the first detailed report on the chemical re-
actions affecting the chlorofluoromethanes CCl₃F and
CCl₂F₂, after their release into the environment. The
only important atmospheric removal process for these
compounds is photodissociation in the stratosphere
by solar ultraviolet radiation. Such photolysis ultimate-
ly results in a long chain reaction that can remove
enough stratospheric ozone to become a global en-
vironmental problem of major significance. [The SC²
indicates that this paper has been cited in over 310
publications.]

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During 1973 I proposed to the US Atomic Energy
Commission (AEC) (which had sponsored my radio-
chemical research since 1956) that we expand our
investigations of trace radioactive isotopes in gas-
phase laboratory experiments into an examination of
the atmospheric fate of the nearly inert chloro-
fluoromethanes, which two years earlier had been
detected in minute quantities in tropospheric air.

The actual investigations began when Mario J.
Molina joined my research group as a postdoctoral
research associate in 1973. Chlorofluoromethanes
are inert under most atmospheric conditions, and we
soon deduced that they would survive in the atmo-
sphere for an average of 50 to 150 years before being
decomposed by very short wavelength solar ultra-
violet (UV) radiation. This UV radiation normally
cannot reach the earth's surface because it is inter-
cepted by ozone in the stratosphere above it.

The decomposition of inert chlorofluoromethane
compounds releases highly reactive atomic chlorine
that proceeds to react with ozone, converting it into
ordinary oxygen molecules. When our study dis-
closed the existence of a chlorine-atom catalyzed
chain reaction, the work suddenly took an ominous
turn, and we recognized the global environmental
problem because it would allow the existence of a
chlorine-atom catalyzed destruction of ozone.

The long-term environmental consequences of the
chlorofluorocarbon-ozone problem have again
derived from the published scientific litera-
ture when we discovered it for ourselves.

Our initial short paper on the chlorofluorometh-
one-ozone problem was written and submitted to
Nature in late January. However, the scientific, po-
litical, and regulatory ramifications of this research
were so widespread that we felt obligated to publish
much more detailed exposition than that contained
in the limited space provided for the Nature paper.

1. Molina M J & Rowland F S. Stratospheric sink for chloro-
fluoromethanes—chlorine atomic catalysed destruction of ozone. 
Nature 249:810-2, 1974. (Cited 170 times.)


3. Farman J C, Gardiner B G & Shanklin J D. Large losses of total ozone in Antarctica reveal seasonal ClO/NO, 


5. Rowland F S, Sato H, Kawa H & Elliott S M. The hydrolysis of chlorine nitrate and its possible atmospheric 