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On the enhancements of backtracking methodologies achieved since the Chernobyl accident

A. Becker, G. Wotawa, L.-E. De Geer

Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization, Vienna, Austria (andreas.becker@ctbto.org, gerhard.wotawa@ctbto.org, ledg@ctbto.org, Fax: +43-1-26030-5973)

In the morning of 28 April 1986 radioactive contamination was detected on workers leaving the night shift at a Swedish nuclear power plant. That triggered an immediate exchange and analysis of filters exposed in nearby Stockholm at a station that was part of a network run by the Swedish Defence Research Institute to detect debris from nuclear explosions. In a few minutes it was clear from this analysis that the high concentration of radionuclides was due to a reactor accident that had recently occurred somewhere in the south-western Soviet Union. In the evening the Soviet authorities confirmed that there had been a severe accident at Chernobyl in Ukraine three days before in the early hours of 26 April. The Swedish localization was done by an automatic trajectory routine that in this case actually worked quite well. Dating the event from the measured ratios of the iodine isotopes actually pinpointed Chernobyl as the most probable site for the accident. But this was nothing that could be truly counted on as in more complex meteorological situations one would need to apply true dispersion models that also take vertical motion into account. Utilization of the today's geo-temporal resolution of analysis wind fields would provide the required backtracking accuracy even for regions where the average distance between nuclear power plants, or any other potential source of pollution, is much shorter than between the nuclear power plants in Ukraine. This paper presents a comparison of the methodologies applied in 1986 with those available today in the field of air pollution modelling. In particular the backtracking methodology implemented at the Provisional Technical Secretariat (PTS) to the Preparatory Commission of the Comprehensive Nuclear Test-Ban Treaty (CTBT) is described and validated for the Chernobyl case in order to elucidate today's capabilities in source localization by atmospheric transport modelling methods.