

Hamburgers emit more particles than diesel trucks

Robin Meadows

Hamburgers are a double health threat, polluting the air and clogging arteries. “Hamburgers account for more than twice as many [emitted] particles as are released by diesel trucks”, says Bill Welch, an environmental engineer at the University of California, Riverside. He estimates that charbroiling a single patty emits as many particles as driving 225 kilometers in an 18-wheel diesel truck.

Most of the smoke from charbroiled burgers is composed of vaporized fatty acids that form particles under 2.5 microns, the size class that poses the greatest health threat. Linked to severe asthma attacks, respiratory infections, and lung cancer, these fine particles “get deep into

people’s lungs and can’t be dislodged”, Welch explains.

Restaurants are the top source of fine particles in California’s South Coast Air Basin, which includes Orange, Los Angeles, and Riverside counties and has among the worst air quality nationwide. The Basin’s fine-particle levels exceed $54 \mu\text{g m}^{-3}$ per day, far above the federal 24-hour standard of $35 \mu\text{g m}^{-3}$ that must be met by 2015. The next biggest sources of airborne fine particles are paved road dust, which includes tiny bits of brake pads, and residential fuel combustion.

Commercial cooking in the region emits more than 11 tons of fine particles per day, 85% of which comes from charbroilers in independent (non-chain) restaurants. “Lots of these are mom-and-pop places”, Welch observes. “They need pollu-

tion controls that are effective and economical.” Current control methods can cost \$100 000 or more.

To evaluate new ways of cleaning hamburger smoke, Welch’s team has set up a mock restaurant in the lab. “We cook 15 burgers every 7 minutes, and no, I can’t eat them anymore”, he admits, estimating that he has cooked 4 tons of burgers over his career. A series of installed filters has worked well, but they accumulate grease so fast – more than a kilogram in just half a day – that filter replacement costs may be too high for small food outlets.

Welch is also investigating burger smoke for additional health effects. “Diesel exhaust is regulated as a toxic substance”, he points out. “In burger smoke, there are about 350 compounds, some of which are toxic.” ■

Arctic dumping grounds raise questions, concerns

Nancy Bazilchuk

The remote reaches of the Barents and Kara seas have come under increased scrutiny in recent months, after a joint Norwegian–Russian research cruise was dispatched to examine nuclear waste dumped into the ocean decades ago by Russia and the former Soviet Union. Marking the first time that the sites have been examined in 18 years, the cruise is also the first conducted since the Russians revealed in 2009 that they had dumped nearly twice as much waste in the area as they had previously reported.

At the same time, petroleum and natural gas companies – including ExxonMobil and the Russian company Rosneft OAO – are gearing up to explore for oil in the region, which has environmental activists in Norway and Russia demanding that more be done to limit any risks posed by the radioactive waste.

The joint Norwegian–Russian cruise returned to port in late September. Its preliminary results showed radiation levels at the inspected sites



Scientists process seawater to test for radiation during a joint Norwegian–Russian research cruise to the Kara Sea.

to be generally low, essentially unchanged since they were last measured in 1994, says Per Strand, director of the Norwegian Radiation Protection Authority’s (NRPA’s) Department for Emergency Preparedness and Environmental Radioactivity (Østerås, Norway). “However, the dumped objects represent a potential source of radioactive contamination in the future”, he adds.

According to Strand, one priority for the cruise was to examine a nuclear submarine, the K-27, which was scuttled in 1982 off Novaya Zemlya, an Arctic island roughly

1000 kilometers east of the Norwegian border. The K-27 contains two experimental liquid lead–bismuth reactors with highly enriched fuel for which, as stated by the NRPA report, the possibility of a nuclear chain reaction could not be excluded”. By using a remotely operated underwater vehicle, the cruise researchers were able to inspect the sub and found it to be intact, although several of its hatches were missing. Before scuttling the K-27, the Russians pumped its reactor area full of a combination of bitumen and an acetone resin called furfural, with the intention of isolating the reactors from future breaches.

The tally of known wastes submerged in the area includes three intact nuclear-powered submarines with fuel, a single submarine reactor with fuel, five reactor sections from various nuclear-powered vessels, 19 ships loaded with solid radioactive waste, 735 other radioactive items, and more than 17 000 individual containers of radioactive waste. In comparison, the Russians had previously reported dumping roughly 11 000 nuclear waste containers. ■