

6.7 Sources of offensive odors

6.7.1 State of offensive odor complaints

When the number of complaints annually by type concerning the seven major pollutants as compiled by the Environmental Disputes Coordination Commission are examined, offensive odors are second only to noise, occupying a total of approximately 17% of complaints as a whole. This has not changed in the more than 20 years since these surveys began ¹⁾.

When the sources of these offensive odor complaints are examined for 1995, the most common area is the "services and others" category, at 2,930 complaints, or 26.0% of the total, followed by the "livestock and farming industry" at 1,824 complaints (16.2%). In third place comes "private housing, apartments, and dormitories" at 1,481 complaints (13.1%). Further, the food processing industry, chemical plants, and other manufacturing plants within the manufacturing industry occupy a total of approximately 1/4 of all complaints, while as before, offensive odors are one of the largest causes of complaint (Fig.6.7.1). Moreover, in the "service industry and others" category, the majority of complaints are to do with restaurants, field burning, automobile repair plants, dry cleaners, and so forth, and in the same way, in the "other manufacturing plants" category, the majority of complaints are addressed against paint factories, metal products manufacturing plants, woodworking plants, and so on ²⁾. Given these trends, the outstanding feature of offensive odor complaints in recent years has been a tendency towards an increase in the percentage of offensive odors caused by daily living, such as ordinary private housing, apartments, and dormitories, sewage, and tap water, and the offensive odor complaints relating to urban living account for 46.2% of all complaints as a whole.

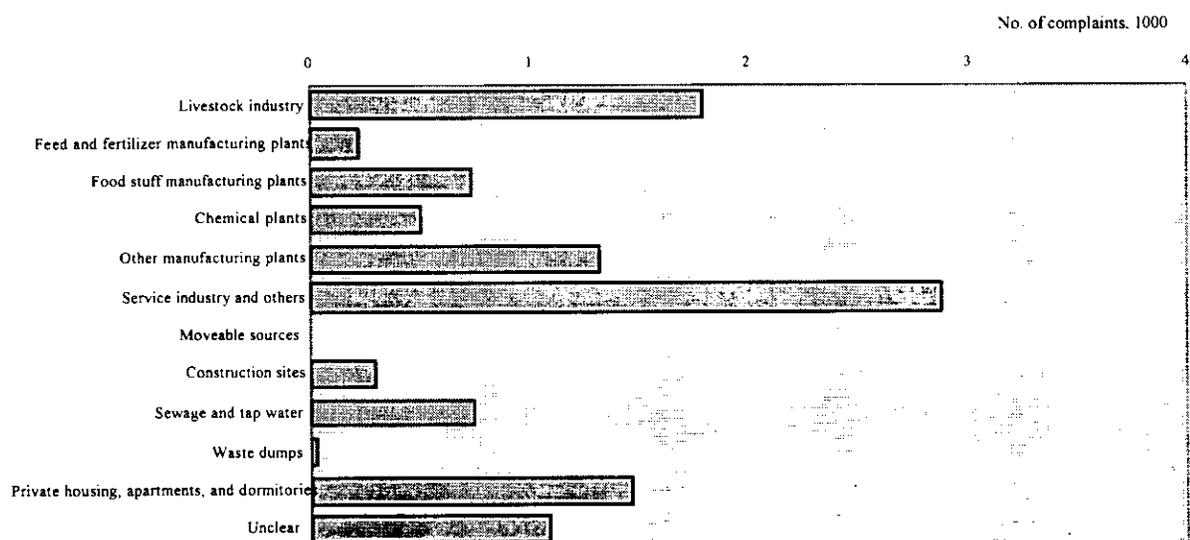


Fig.6.7.1 Offensive odor complaints in Japan (1995)

6.7.2 Worksites generating specific offensive odor substances

The Offensive Odor Control Law regulates as its target 22 proscribed substances such as ammonia, hydrogen

sulfide, fatty acids, and so forth, and these substances are called specific offensive odor substances. The main sources of these specific offensive odor substances are shown in table 6.7.1³⁾.

Table 6.7.1 Main sources of specific offensive odor substances

Ammonia	Livestock and farming industry, chicken excrement drying sites, compound fertilizer manufacturing, starch manufacturing, dead animal processing plants, fish entrails and bone processing plants, feather processing plants, waste disposal plants, raw sewage treatment plants
Methyl mercaptane	Craft pulp manufacturing, chemical plants, fish entrails and bone processing plants, waste processing plants, raw sewage treatment plants, sewage treatment plants
Hydrogen sulfide	Livestock and farming industry, craft pulp manufacturing, starch manufacturing, cellophane manufacturing, viscous rayon manufacturing, dead animal processing plants, fish entrails and bone processing plants, feather processing plants, waste processing plants, raw sewage treatment plants, sewage treatment plants
Methyl sulfide	Craft pulp manufacturing, dead animal processing plants, fish entrails and bone processing plants, waste processing plants, raw sewage treatment plants, sewage treatment plants
Methyl disulfide	Craft pulp manufacturing, dead animal processing plants, fish entrails and bone processing plants, waste processing plants, raw sewage treatment plants, sewage treatment plants
Trimethyl amine	Livestock and farming industry, compound fertilizer manufacturing, dead animal processing plants, fish entrails and bone processing plants, fishing industry canneries
Acetaldehyde	Acetaldehyde manufacturing plants, acetic acid manufacturing plants, vinyl acetate manufacturing plants, chloroprene manufacturing plants, tobacco manufacturing plants, compound fertilizer manufacturing, fish entrails and bone processing plants
Aldehydes Propion aldehyde n-Butylaldehyde abutyl aldehyde n-Valeraldehyde Isovaler aldehyde	Paint factories, other metal manufacturing plants, automobile repair plants, printing plants, fish entrails and bone processing plants, oil and fat food processing plants, transport machinery and equipment manufacturing plants
Solvents Isobutanol, Ethyl acetate Methyl isobutyl ketone Toluene, xylene	Paint factories, other metal manufacturing plants, automobile repair plants, woodworking plants, fiber plants, other machine manufacturing plants, transport machinery and equipment manufacturing plants, foundries
Styrene	Styrene manufacturing plants, polystyrene manufacturing plants, SBR manufacturing plants, FRP manufacturing plants, cosmetic plywood manufacturing plants
Propionic acid	Fatty acid manufacturing plants, dye plants, livestock sites, dead animal processing plants, starch manufacturing plants
n-Butyric acid, n-Valeric acid, Isovaleric acid	Livestock sites, starch manufacturing plants, dead animal processing plants, fish entrails and bone processing plants, livestock food processing plants, raw sewage treatment plants, waste disposal plants

6.7.3 Impact of the main offensive odor generating worksites

The examination of emissions of offensive odors generated by offensive odor generating worksites, and the relationship to the extent of local environmental impact by these offensive odors, is important from the point of view of discussing anti-offensive odor measures. Generally, in order to investigate the environmental impact caused by

sources of offensive odors, methods are adopted for calculating the environmental concentration using various diffusion algebraic formulae. However, in the case of offensive odors, understanding specific sources and the amount generated is problematic, and there are many cases where there is a disparity with reality. Shigeta used the TOER (Total Odor Emission Rate) and have come to calculate the impact of offensive odors experimentally as shown in Table 6.7.2⁴⁾. Moreover, the OER is a value that multiplies the amount of gas emitted (m³/min.) by the odor concentration of their source, and the TOER, when there are multiple sources within the same worksite, is the sum of all the various OERs⁴⁾.

Table 6.7.2 Relationship between TOER and range of effects

TOER	Causes of offensive odor pollution Condition	Typical examples of originating industries (No offensive odor protection law)	Area of impact
Max. 10 ⁴	Only in special circumstances	Bakeries Distilleries	
10 ⁵⁻⁶	Although offensive odor pollution is only happening on a small scale at present, includes the possibility.	Paint and solvent factory Printing and ink plant Leather factory, FRP works Feed and fertilizer plant Sewage treatment plant	Maximum distance reached by offensive odor is 1 to 2 km, offensive odor complaints are centered on a 500 m radius, with no complaints from 1 km or more away.
10 ⁷⁻⁸	Offensive odor pollution is happening on a small to medium scale.	Foundries Raw sewage treatment plants Pig and chicken farms Petroleum chemical plants	Maximum distance reached by offensive odor is 2 to 4 km, offensive odor complaints are centered within a 1 km radius.
10 ⁹⁻¹⁰	Offensive odor pollution is happening on a large scale.	KP plants Cellophane plants Dead animal processing plants Rayon plants	Maximum distance reached by offensive odor is within 10 km, offensive odor complaints are centered within a 2 to 3 km radius.
10 ¹¹⁻¹²	A few examples at the largest offensive odor source.	Large-scale KP plants with no anti-pollution measures.	Maximum distance reached by offensive odor is 10 km, with damage occurring within a 4 to 6 km radius.

6.7.4 Main worksite offensive odor sources

In the case of offensive odors, pinpointing the sources is not necessarily an easy task. Predictable sites vary, and an odor generated from an unexpected site can have a major impact on the local surroundings. Mr. Takahashi⁵⁾ has compiled a report on the sources and concentrations of offensive odors generated in sewage treatment plants. The state of generation of offensive odors in sewage treatment plants is shown in Table 6.7.3. Further, Mr. Tanigawa⁶⁾ has reported on the offensive odors generated by the treatment and disposal of urban waste and, as classifications of those odors, has broken them down into offensive odors generated by waste itself, offensive odors generated by waste processing (gasses emitted by burning, compost processing, landfills, etc.), and other (exhaust gas from garbage trucks, waste water treatment facilities, etc.). The main sources of offensive odors from urban waste processing and disposal are shown in Table 6.7.4.

Table 6.7.3 Offensive odor sources and odor concentrations at sewage treatment plants

Offensive odor source	Minimum value	Maximum value	Geometric mean
Reserve aeration tank	730	7,300	2,300
Grit chamber	14	2,300	210
Screen combers	980	2,300	1,500
Gravity thickener concentration tank	230	230,000	6,200
Vacuum filters	<10	310	28
Pressure filters	<10	10	<10
Belt press filters	5,500	13,000	7,300
Centrifugal dehydrator	—	—	55
Multihearth furnace exhaust gasses	3,100	55,000	16,000
Precipitation	18	41,000	220
Aeration tank	10	1,900	110
Sludge cleaning tank	<10	980	120

Table 6.7.4 Main sources of offensive odors in waste treatment and processing

Waste treatment and processing	Offensive odor sources	Types of offensive odor
Collection	Waste dumps Dump trucks	Offensive waste odors, offensive automobile gas emissions Offensive waste odors, offensive automobile gas emissions
Transportation	Dump trucks	Offensive waste odors, offensive automobile gas emissions
Intermediate processing	Urban waste Incinerator facilities Platform Waste pits Stacks Ash pits Environmental countermeasure facilities Garbage hauling vehicles	Offensive waste odors, offensive automobile gas emissions Offensive waste odors Offensive odors from incinerator gasses Offensive odors from ash pits Offensive waste water odors, offensive pharmaceutical odors Offensive automobile gas emissions, offensive waste odors Offensive ash incineration odors
Final disposal	Landfills	Offensive landfill odors, offensive waste odors, offensive ash incineration odors. Offensive motor vehicle exhaust gas, offensive waste water odors

The main sources of offensive odors generated by other offices are shown below by worksite.

Table 6.7.5 Main sources of offensive odors generated by other offices

Worksites	Main sources of offensive odors
Livestock and farming industry:	Pig pens, henhouses, excrement and its processing facilities, fertilizer dumps, fertilizer drying facilities.
Chemical processing plants:	Cookers, presses, dryers, and their waste steam, waste water processing equipment, raw material dumps, concentration equipment drains.
Paint factories:	Paint booths, etching, glazing kilns.
Print works:	Drying equipment built into printing machines, printing parts, cleaning work on plates and rollers, printing ink, mixing work such as with dilutants, ink and solvent store rooms.
Food processing plants:	Waste water, burning of raw materials and packaging, fumigants, boiler smoke, raw material dumps.
Petrol refineries ⁷⁾ :	Gas by-products from distillation equipment, decomposing equipment, hydroxide refining equipment, and sulfur separating equipment, sulfur recovery equipment, storage facilities, flare stack, waste water.
Chemical plants ⁸⁾ :	Reaction facilities, distillation facilities, absorption and adsorption facilities, drying facilities, burning facilities.
Sewage treatment plants ⁹⁾ :	Grit chamber, sedimented basin, aeration tank, inspection hoppers, Grit hoppers, concentrated sludge tank, sludge storage tank, mud elimination tank, water extractors, sludge incinerators.
Raw sewage treatment facilities ¹⁰⁾ :	Insertion pores, insertion rooms, aeration tank, elimination tank, concentration tank, sludge processing facilities, sludge incinerators.
Craft pulp manufacturing ¹⁰⁾ :	Distillation threshers, evaporators, recovery boilers, lime kilns.