3.1.2.7 Nonradiological materials

This section discusses the potential impacts resulting from NMI's use of several acids: hydrochloric (HCl), hydrofluoric (HF), fluoroboric (HBF_4), and sulfuric (H_2SO_4). Table 3.10 shows the volumes of acids present at NMI and the corresponding quantities of the hazardous substances contained within the acid solutions. Both HCl and HF are present in 415-L (110-gal) tanks. The HCl is a 20 percent (2.4 *N*) solution and the HF is a 50 percent (10.9 *N*) solution.

Large quantities of sulfuric acid are used or stored primarily in two locations at NMI: in Building E (near the resource recovery area) and in the receiving area in the B-4 building. In Building E, a 5 percent (1.8 *N*) solution of H_2SO_4 is contained in two 7,570-L (2,000-gal) tanks; however, the total volume of acid never exceeds 11,360 L (3,000 gal). An additional 415 L (110 gal) of concentrated sulfuric acid [approximately 93 percent (35 *N*) solution] may be found in two 208-L (55-gal) day tanks, also in Building E near the resource recovery area. This 415-L (110-gal) amount represents a recent reduction in H_2SO_4 used in the day tanks based on a commitment by NMI to decrease the amount in one of the tanks from 570 L (150 gal) to 208 L (55 gal) (D.S. Schlier and G. Shinopulos, Nuclear Metals, Inc., Concord, Mass., office memorandum, "Sulfuric Acid Use in E Building," to E. Anderson, Nuclear Metals, Inc., Concord, Mass., July 30, 1996). One drum [340 kg (750 lb) net weight; approximately 190 L (50 gal)] of concentrated sulfuric acid may also be present in Building E near the resource recovery area. Based on these volumes and concentrations, the total quantity of H_2SO_4 in Building E is 2,030 kg (4,480 lb), as shown in Table 3.10. Up to four drums of concentrated sulfuric acid containing a total of 760 L (200 gal) may also be present in the receiving area. As shown in Table 3.10, the total quantity of H_2SO_4 in the receiving area is 1,270 kg (2,800 lb).

The HBF_4 is present in a 2 percent (0.16 *N*) solution, but only in a single 19-L (5-gal) tank. In large enough quantities, each of these acids is hazardous to humans. However, the quantity of HBF_4 stored at the facility is so small that an atmospheric release of the entire amount would have a negligible impact on the environment. Therefore, HBF_4 is not analyzed further.

Table 3.10. Volumes of acids present at Nuclear Metals, Inc. facilities and corresponding quantities of the hazardous substances contained within the acid solutions

Acid	Acid concentration [percent (normality)]	Acid volume [L (gal)]	Hazardous substance	Quantity of hazardous substance (kg[a])
Hydrochloric	20 (2.4 *N*)	415 (110)	HCl	36
Hydrofluoric	50 (10.9 *N*)	415 (110)	HF	91
Sulfuric	5 (1.8 *N*)	11,360 (3,000)	H_2SO_4	1,000[b]
Sulfuric	93 (35 *N*)	605 (160)	H_2SO_4	1,030[b]
Sulfuric	93 (35 *N*)	760 (200)	H_2SO_4	1,270[c]
Fluoroboric	2 (0.16 *N*)	19 (5)	HBF_4	0.3

[a]1 kg = 2.2 lb.

[b]This material is located in Building E, near the resource recovery area. The combined H_2SO_4 quantity in Building E is 2,030 kg (the sum of 1,000 kg and 1,030 kg); of this amount, only 1,620 kg is deemed credible as an upper bound on the available source term for use in accident analyses (see text for additional details).

[c]This material is located in the receiving area of the B-4 building.

The evaluation of the potential impacts of these nonradiological materials was based on a release to the atmosphere using the same accidental fire scenario as for the radiological materials. The analysis of the atmospheric dispersion of these nonradiological materials followed the same set of assumptions and procedures discussed in Section 3.1.2.3, with the exception that the primary release mechanism was assumed to be the evaporation or volatilization of the hazardous acids due to the heat of the fire. Once airborne, the hazardous materials were assumed to be entrained by the thermal effects of the fire and dispersed in the atmosphere as they traveled downwind. The potentially affected individual was assumed to be located 100 m (330 ft) downwind of the accidental release. Except as described in the paragraphs below for H_2SO_4, the source term for each of the acid hazards was taken to be the maximum amount of hazardous substance presented in Table 3.10.

Because a nearly total failure of fire safety systems during a hot, lengthy fire would be required to vaporize the large quantity of sulfuric acid present, the entire amount of H_2SO_4 at NMI was deemed to be inappropriate for use as a source term in the accident analysis. An upper bound on the material potentially at risk was derived from three considerations: (1) a credible fire would affect the acid inventory in a single building only (corresponding to the analysis for a fire involving radiological materials); (2) floor drains are present in the immediate vicinity of the sulfuric acid tanks and drums in Building E; and (3) approximately 30,300 L (8,000 gal) of liquid are contained in wastewater treatment tanks adjacent to the resource recovery area in Building E.

In the event of a fire in Building E, the plastic wastewater tanks would fail, dumping their contents on the floor and diluting any acid present. In addition, the majority of water piping in Building E is plastic and would fail in a fire, allowing additional dilution of any spilled sulfuric acid. Further, the sprinkler system would flood the area with water at a rate of 13 L/s (200 gpm). For the purposes of this analysis, however, it is assumed that the entire amount of sulfuric acid in Building E is spilled in an accident and that only the liquid in the wastewater tanks is available to dilute the spilled acid. The total amount of liquid (acid plus wastewater) on the floor in Building E would thus be 42,265 L (11,160 gal).

Five floor drains near the sulfuric acid in Building E have the capacity to remove about 28 L/s (450 gpm) of liquid; thus, if the total 11,965 L (3,160 gal) of sulfuric acid were the only liquid on the floor, it could be removed from the building in just over 7 minutes, an inadequate time for significant vaporization to occur during a fire. On the other hand, if the total volume of wastewater plus acid were spilled, the drains would remove all of the liquids from the building in about 28 minutes. For the purposes of this analysis, it is conservatively assumed that the drains would only operate for 5 minutes before becoming plugged by debris from the fire.

With 5 minutes of drain operation and with 42,265 L (11,160 gal) of wastewater plus sulfuric acid spilled on the floor, a total of 1,620 kg (3,570 lb) of H_2SO_4 (about 80% of the total H_2SO_4 initially in the tanks, drums, and day tanks in Building E) would remain inside the building and would be available for vaporization and subsequent atmospheric dispersion in the event of a fire. Because this quantity is greater than the 1,270 kg (2,800 lb) stored in the four drums in the receiving area of the B-4 building (see Table 3.10), and because only one building is assumed to be affected by a credible fire, the 1,620 kg (3,570 lb) from Building E was used as the H_2SO_4 source term in the dispersion analyses below.

Table 3.11 displays the maximum predicted concentrations and related exposure limits of concern for each of the acid hazards. In addition to the ERPG-2 limit defined earlier, the exposure limits are: (1) the ERPG-3 limit, established by the American Industrial Hygiene Association as the maximum concentration to which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects; (2) the immediately dangerous to life and health (IDLH) threshold value, established by the National Institute of Occupational Safety and Health (NIOSH) as the maximum atmospheric concentration from which a person could escape within 30 minutes without a respirator and without experiencing irreversible health effects or escape-impairing effects (e.g., severe eye irritation); and (3) the LC_{50}, the concentration which would result in fatalities to 50 percent of the exposed population. The limits are expressed as concentrations in breathable air and are stated in conjunction with an applicable duration of exposure.

Each acid hazard was analyzed separately, and no combinations or synergistic effects were included in the analysis. In relation to the analysis presented in Section 3.1.2.4, the following assumptions were made for these hazardous materials:

- Except for H_2SO_4, the damage ratio was assumed to be 100 percent (DR = 1.0), that is, the entire acid inventory was assumed to be affected by the fire. For H_2SO_4, the damage ratio was assumed to be 80 percent, as discussed above.
- The release fraction was assumed to be 100 percent (RF = 1.0); that is, the entire affected inventory was assumed to become airborne.
- The respirable fraction was assumed to be 100 percent (r_f = 1.0); that is, the entire airborne quantity was assumed to be respirable. This is consistent with the vaporous nature of these acids.

Although the collective set of above values is conservative and will overestimate the amount of nonradioactive hazardous material reaching a downwind individual, the above values are used in the accident analysis due to the lack of better data.

Table 3.11 Maximum predicted concentrations and related exposure limits associated with acid hazards at Nuclear Metals, Inc. facilities

Hazardous substance	Maximum concentration (mg/m^3)[a]	Type of exposure limit[b]	Value of exposure limit (mg/m^3)	Associated exposure period (minutes)	Ratio of concentration to exposure limit (in percent)
HCl	17	IDLH	75	30	23
		ERPG-2	30	60	57
		ERPG-3	149	60	11
		LC_{50}	1,400	120	1
HF	42	IDLH	25	30	168
		ERPG-2	16	60	263
		ERPG-3	58	60	72
		LC_{50}	650	120	6
H_2SO_4	740[c]	IDLH	15	30	4,933
		ERPG-2	10	60	7,400
		ERPG-3	30	60	2,467
		LC_{50}	850	120	87

[a]Maximum concentrations estimated for a receptor located 100 m (330 ft) downwind of an accidental release using the method outlined in Sect. 3.1.2.4.

[b]IDLH = immediately dangerous to life and health; ERPG-2 = Emergency Response Planning Guideline-Level 2; ERPG-3 = Emergency Response Planning Guideline-Level 3; LC_{50} = concentration which would result in fatalities to 50 percent of the exposed population.

[c]Maximum concentration calculated assuming 1,620 kg of H_2SO_4 in Building E is released in a 2-hr period.

HCl. The predicted 2-hr concentration that results from the entire mass of HCl being released to the atmosphere in a fire is 17 mg/m^3. The ERPG-2 for HCl is 30 mg/m^3, the ERPG-3 is 149 mg/m^3, and the IDLH is 75 mg/m^3. The predicted concentration is below the level that would cause irreversible effects, but it is above the irritation threshold of 15 mg/m^3. Therefore, an exposed person would not be expected to voluntarily stay in the plume but would leave the plume, if capable. In addition, the predicted 2-hr concentration is well below the LC_{50} of 1,400 mg/m^3 for a 2-hr exposure to HCl.

HF. The predicted 2-hr concentration that results from the entire mass of HF being released to the atmosphere is 42 mg/m^3. The ERPG-2 for HF is 16 mg/m^3 and the IDLH is 25 mg/m^3. The predicted concentration is above the ERPG-2 and IDLH, but it is below the ERPG-3 of 58 mg/m^3. The predicted concentration is well below the LC_{50} of 650 mg/m^3 for a 2-hr exposure to HF. With an irritation threshold of 15 mg/m^3, HF is irritating at the predicted concentration and would not be tolerated voluntarily by a person exposed to the plume.

H_2SO_4. Assuming that 1,620 kg of H_2SO_4 is released from Building E to the atmosphere in a fire, the maximum estimated 2-hr concentration is 740 mg/m^3. Because this concentration is greater than that predicted for the 1,270 kg of H_2SO_4 in the receiving area, the latter is not presented. The ERPG-2 for H_2SO_4 is 10 mg/m^3, the ERPG-3 is 30 mg/m^3, the IDLH is 15 mg/m^3, and the LC_{50} for a 2-hr exposure is 850 mg/m^3. The predicted concentration of H_2SO_4 is below the LC_{50} but higher than the ERPG levels. The potential impact of H_2SO_4 is a concern; however, with an irritation threshold of 2 mg/m^3, H_2SO_4 would not be tolerated voluntarily at the predicted level for more than a few seconds.

All of the acids are very irritating to the mucous membranes and eyes. For all of the acids, the irritating symptoms occur at relatively low concentrations with respect to concentrations likely to result in serious health effects. Thus, a person with any mobility would not remain in the plume for more than minutes, and possibly seconds. The nature of a fire is that a period of time would be required for high temperatures to develop, after which time the acids would heat up and begin to boil/evaporate. Thus, there would be an increasing concentration during the beginning phase of the acid release. None of the concentrations would be high enough to cause mortality from an exposure of a few seconds, but they would be high enough to cause appreciable irritation within seconds to minutes.

The results of these analyses are conservative (form an upper bound of expected concentrations). However, because the maximum predicted H_2SO_4 concentration exceeds all of the ERPG levels, ...**[this text is being forwarded to the Massachusetts Department of Environmental Protection for disposition].**

3.1.3 Environmental Justice

On April 21, 1995, NRC's NMSS issued Policy and Procedures Letter 1-50, Revision 1, titled "Environmental Justice in NEPA Documents," providing interim guidance for compliance with Executive Order 12898 on Environmental Justice to serve until guidelines are available from the Council on Environmental Quality (CEQ). The purpose of Executive Order 12898 is to ensure that minority and low-income populations do not suffer "disproportionately high adverse human health or environmental effects" as a result of federal programs, policies, and activities. NRC interim guidance further stipulates that the potential for environmental justice concerns can exist only if minorities or households in poverty exceed state or county averages by 20 percent.

Because of the rural nature of the area, this assessment to evaluate environmental justice considers a potential area of impact recommended by NMSS for rural regions [i.e., a 130 km^2 (50 $mile^2$) area around the site which has a radius equal to 6.5 km (4 miles)]. This area includes parts of the incorporated towns of Concord, Acton, Sudbury, and Maynard. Following consultation with planners in each of the four towns (Alfred Lima, Director of Concord Office of Planning and Land Management; Acton Planning Department; Dorothy Burke, Sudbury Planning Office; and Judy Peterson, Maynard Planning Office, personal communication with Inga E. Treitler, Oak Ridge National Laboratory, Oak Ridge, Tenn., April 26, 1995), a site visit and assessment by ORNL staff (May 11, 1995), and a literature search (e.g., Garrelick 1992:147-174), the staff determined that the population in the four towns is reasonably homogeneous and that population data gathered for each of these towns

3.1.5 Mitigation Measures

Mitigation measures have been developed to minimize potential environmental impacts associated with operation of the NMI facility. NMI reports the quantities and locations of hazardous materials on an annual basis, as required under regulations promulgated for the Community Right-to-Know Act. NMI also works with the local fire department and HAZMAT (hazardous materials) District No. 14 to familiarize emergency response personnel with NMI's layout and inventory of radiological and chemical hazards. NMI provides tours for these personnel at least once per year.

With regard to an accidental release of H_2SO_4, the maximum predicted concentration in the ambient air exceeds all of the ERPG levels. However, because the irritation threshold for H_2SO_4 is sufficiently less than the ERPG levels, all able-bodied people would be capable of speedily and voluntarily evacuating. **[This text is being forwarded to the Massachusetts Department of Environmental Protection for suggested mitigation measures, if any.]**

With regard to SO_2 emissions during normal operations, NMI is prepared to undertake mitigative action to prevent potential exceedances of the short-term SO_2 NAAQS. Although NMI has not yet committed to a specific mitigation measure, the Commonwealth of Massachusetts and NMI have initiated discussions to determine appropriate mitigative action and ensure compliance with the NAAQS.

3.2 ENVIRONMENTAL CONSEQUENCES OF NO ACTION

Under the no-action alternative, NRC would not renew NMI's licenses and all processing, handling, storage, and other operations involving radioactive material would cease at the facility. However, operations involving nonradioactive material (e.g., beryllium processing) would continue. Therefore, criteria pollutant emissions associated with the boiler would be expected to continue at levels equal to or below current operations, and impacts would be the same as or slightly less than those described in Section 3.1.1.3. Because