APPENDIX H

EXCERPT FROM SAN FRANCISCO ESTUARY INVASIVE SPARTINA PROJECT
SAN FRANCISCO ESTUARY INVASIVE SPARTINA PROJECT:
SPARTINA CONTROL PROGRAM

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mutagenicity, carcinogenicity, and teratogenicity, and found that this chemical does not elicit negative effects and is excreted unchanged (Washington State 1993).

**Project Worker Exposure Effects**

The potential for human health effects from the application of glyphosate depends on the potential human exposure routes, and the toxicity of the herbicide and associated surfactants and impurities. An exposure route describes the ways in which people can be exposed to contaminants in a particular area. Workers could be exposed to glyphosate and other substances if they inhale glyphosate spray droplets or windblown soil particles; if they touch the liquid herbicide during mixing and loading (dermal contact); or by ingesting small amounts of soil or sediment containing glyphosate residues (e.g., for example, sediment clinging to hands or face). Based on the information summarized above, it is highly unlikely that workers applying glyphosate and surfactants with hand-held sprayers or from vehicles or boats would willfully inhale or ingest the quantities that would cause mortality.

The greatest potential for worker exposure is associated with wicking or wiping activities and use of injection devices. These activities are more labor-intensive than spraying and involve greater direct contact with the herbicide. Backpack spraying is more rapid than wicking or wiping, and reduces the potential for the worker to contact the herbicide. However, some spray drift may occur during spraying.

Application of herbicide using boats, trucks, and all-terrain vehicles (ATVs) mounted with a boom sprayer or spot spraying with a hose from these vehicles may also be conducted; these methods allow for more specific application than aerial spraying. Aerial spraying allows quick application to a large area, but has the potential for drift and therefore inhalation of glyphosate spray droplets.

All herbicide application methods involve the potential for dermal (skin) contact from splashes during mixing and loading. As noted above, primary health effects include eye and skin irritation. In California, glyphosate ranks high among pesticides causing illness or injury to workers, who report numerous incidents of eye and skin irritation from splashes during mixing and loading. Use of personal protective equipment (PPE), including protective eyewear, as specified on the product label would minimize this risk. Proper handling of glyphosate and the surfactants in accordance with the labeling requirements would reduce the potential for eye and dermal irritation in workers.

**Mitigation HS-2: Worker Health Effects from Herbicide Application.** Appropriate health and safety procedures and equipment, as described on the herbicide or surfactant label, including PPE as required, shall be used by workers to minimize risks associated with chemical treatment methods. Only certified or licensed herbicide applicators shall mix and apply herbicide.

**Impact HS-3: Health Effects to the Public from Herbicide Application.** Routine application of glyphosate herbicide and surfactants to treat non-native cordgrass may result in adverse health effects to the public, including area residents, recreational visitors, and sensitive subpopulations including children and the elderly. The impact would depend on the herbicide application method, the specific site location, potential receptors in the area, and the size of the area to be treated.

Drift of chemical spray could potentially affect residents living in close proximity to the affected areas, or recreational visitors to the area. Drift from ground application can extend up to about 250 feet, with pesticide concentrations diminishing as the drift gets farther from the source. Drift of herbicides from aerial application has been measured up to 2600 feet (approximately half a mile) from the source (NCAP 2002), however concentrations are substantially diluted with distance from the source. In addition, glyphosate and surfactants are only slightly toxic via the inhalation pathway.
3.6 Human Health and Safety

(Monsanto 2001 and 1998; USEPA 1993). (See information in Impact HS-1, above on the inhalation toxicity of glyphosate.)

Once glyphosate is released into the environment by spraying, it can enter various environmental media including air, surface water, soil, and sediments. The public could be exposed to glyphosate if they contact these media. Potential exposure routes include:

- Inhalation of fine glyphosate spray droplets or windblown soil particles to which glyphosate is adsorbed
- Dermal (skin) contact with airborne glyphosate or glyphosate residues on vegetation, soil, sediments, or surface water
- Incidental ingestion of glyphosate in soil or sediments by inadvertently swallowing soil or sediment (e.g., by touching dirty hands to mouth or by placing dirty objects, such as toys, into the mouth); this exposure route is of greatest importance for children, who tend to engage in activities that can result in soil or sediment ingestion and
- Ingestion of glyphosate by eating food containing glyphosate residues, such as berries, garden vegetables, fish, or shellfish

People who use treated areas for recreation could come into direct contact with vegetation that has recently been sprayed, thus posing a minor risk of skin irritation. Individuals could be exposed to glyphosate and surfactants while playing, walking, swimming, or fishing at or near treatment sites. Glyphosate and surfactants are poorly absorbed through the skin (USEPA 1993), therefore dermal contact is not likely to cause significant health effects.

People who consume plants or wildlife (including fish and shellfish) harvested near the spray area could be exposed to glyphosate and surfactants if present in the plant or animal. However, glyphosate is minimally retained and rapidly eliminated in fish, birds, and mammals (USEPA 2001). Based on these characteristics, and the water solubility and rapid degradation of glyphosate, it is not expected to bioconcentrate in aquatic organisms; therefore glyphosate poses minimal risk to humans via consumption of aquatic organisms.

A quantitative human health risk assessment was conducted during preparation of the EIS for noxious emergent plant management in Washington State to evaluate the potential for adverse human health effects resulting from exposure to glyphosate (product name: Rodeo®, Washington State 1993). In that risk assessment, conservative estimates of non-cancer and cancer toxicity were compared with a conservative estimate of the amount of glyphosate to which the public could be exposed. The routes of exposure evaluated included: inhalation of spray; dermal exposure from vegetation and water; and ingestion of surface water, soil, sediment, wild game, fish, shellfish, garden vegetables, and berries. Potential concentrations in the environment were estimated by assuming that no glyphosate degradation occurred. Potential human intake rates were calculated using reasonable maximum exposure assumptions developed by USEPA (Washington State 1993). Results of the human health risk assessment indicated little potential for adverse non-cancer or cancer health effects from potential exposures related to noxious vegetation treatment. Short-term (acute) and long-term (chronic) cancer and non-cancer health effects for adults and children were all below levels of potential concern (Washington State 1993).

The Washington study included several scenarios that evaluated all receptor pathways and between one and six spray exposures per a receptor’s lifetime. This is conservatively applicable to the Control Program, given the Control Program’s goal of spraying each site annually for either one or two...
years. It also assumed use of Rodeo at an application rate of 3 pounds of active ingredient per acre; this is within the range of glyphosate expected to be used in the San Francisco Estuary, and between the highest concentrations permitted on the label (5.1 pounds/acre) and the mean application rate (2.7 pounds/acre). As noted in the Washington State study, “the over- or underestimation [of active ingredient in spray applications] is expected to be normal, because the differences in exposure point concentrations based on application rates would be minimal (less than an order of magnitude).” Overall, the Washington State study is applicable to the proposed Spartina Control Program because the projects involve similar exposure parameters; therefore, potential health hazards associated with the use of glyphosate and surfactants would be less than significant.

However, the following mitigation measures are suggested to further reduce health risks from exposure to chemical treatment.

**MITIGATION HS-3: Health Effects to the Public from Herbicide Application.** To minimize risks to the public, mitigation measures for chemical treatment methods related to timing of herbicide use, area of treatment, and public notification, shall be implemented by entities engaging in treatment activities as identified below:

- Herbicide application shall be managed to minimize potential for herbicide drift, particularly in areas where the public could be affected. Herbicide shall not be applied when winds are in excess of 10 miles per hour or when inversion conditions exist (per Supplemental Labeling for Aquamaster for Aerial Application in California Only), or when wind could carry spray drift into inhabited areas. This condition shall be strictly enforced by the implementing entity.

- Colored signs shall be posted at and/or near any public trails, boat launches, or other potential points of access to herbicide application sites a minimum of 24 hours prior to treatment. These signs shall inform the public that the area is to be sprayed with glyphosate herbicide for weed control, and that the spray is harmful if inhaled. They will advise “no entry” for humans and animals until a minimum of eight (8) hours after treatment, and that date and time will be stated. A 24-hour ISP contact number shall be provided.

- Application of herbicides shall be avoided near areas where the public is likely to contact water or vegetation as follows:
  
  **A.** Application of herbicides in or adjacent to high use areas shall not be allowed within 24 hours prior to weekends and public holidays.

  **B.** If a situation arises (due to weather or other variables) that makes it necessary to treat high-use areas on weekends or holidays, the areas shall be closed to the public for 24 hours before and after treatment.

- At least one week prior to application, signs informing the public of impending herbicide treatment shall be posted at prominent locations within a 500-foot radius of treatment sites where homes, schools, hospitals, or businesses could be affected. Schools and hospitals within 500 feet of any treatment site shall be separately noticed at least one week prior to the application.

- No aerial spraying shall be conducted within 0.25 mile of a school, hospital, or other sensitive receptor location.

**IMPACT HS-4: Health Effects to Workers or the Public from Accidents Associated with Chemical Treatment.**