UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Date: July 1, 2002
Memorandum

SUBJECT: **Chlorsulfuron: Occupational and Residential Exposure and Risk Assessment/Characterization for Reregistration Eligibility Decision Document and the Proposed use on Pasture and Rangeland Grasses. PC Code:118601 DP Barcode: D283856**.

FROM: Susan Hanley, Chemist
Reregistration Branch 1
Health Effects Division (7509C)

THROUGH: Whang Phang, PhD, Senior Scientist
Reregistration Branch 1
Health Effects Division (7509C)
and
Renee Sandvig, Environmental Specialist
Reregistration Branch 2
Health Effects Division (7509C)

TO: Felecia Fort, Chemist, Risk Assessor
Reregistration Branch 1
Health Effects Division (7509C)

Reviewer: Science Advisory Committee on Exposure;

This document was completed for the reregistration and a new use registration application of DuPont for Chlorsulfuron on pasture and rangeland grasses. Occupational and residential handler and postapplication exposure risks were evaluated.

Executive Summary

The proposed use of Telar® DF Herbicide, a dry flowable concentrate (DF) containing 75 percent of the active ingredient (ai) chlorsulfuron, is on rangeland and pasture grasses. The herbicide is a systemic pesticide and can be applied pre- or post-emergence, early season application results in best efficacy. With the use pattern and site information, no more than short-term exposure (1-28 days) was expected . The proposed rate is 1 oz ai/Acre (A)/season which is within rates currently registered for chlorsulfuron on cereal grains (wheat, barley and fallow fields). Chlorsulfuron can be applied by groundboom, high pressure handwand or airplane. Chlorsulfuron is also registered for use on lawns and turf, therefore residential handler and postapplication exposures are evaluated.

The short-term dermal and inhalation toxicity endpoint selected by HED's Hazard Identification Assessment Review Committee (HIARC) was hyper-reactivity seen at the 200 mg/kg/day dose (LOAEL). The dose for risk assessment selected was 75 mg/kg/day (NOAEL). The standard uncertainty factors for the inter- (10X) and intra-species (10X) differences were selected for short and intermediate term exposures. An additional 3X database uncertainty factor was employed for the incomplete database on the non-occupational (residential) risk assessment (lack of a 2-generation reproduction study, an acute neurotoxicity study, and a subchronic neurotoxicity study). The resulting target margins of exposure (MOE) for occupational and residential exposure risks were 100 and 300, respectively.

The worker exposure and risk assessment presented in this document was based on the Pesticide Handler Exposure Database Version 1.1 (PHED, 1998) and standard assumptions for postapplication exposure. There were no chemical-specific data available to assess potential exposure to workers for chlorsulfuron. The exposure assessment used the application rate range on cereal grains and pastures/lawns of 1 to 4 oz ai /A and baseline clothing (long pants, long-sleeved shirt, socks and shoes). The values for daily acreage treated in agriculture were from HED Exposure Science Advisory Committee (Expo SAC) Policy #09.1. Due to the early season use and crops/areas with little worker activity, no postapplication exposure was expected.

Since lawn use is on the label, residential exposure risk has been evaluated for adult handler and adult and toddler postapplication exposure to treated turf. The directions indicate use as a spot treatment on turf with "a rate of 1.0 to 5.33 ounces per acre to cover 725 to 4000 sq.ft depending upon weed species." Due to this language, and 75 percent active ingredient concentration, 0.25 lb ai/ Acre (A) or 0.0057 lb ai/1000 sq ft. was assessed for residential spot treatment. Residential exposure risk was assessed using the standard values and assumptions from the Residential Exposure Assessment Standard Operating Procedures (ResSOPs). The risk assessment showed adult handler exposure risk was not of concern (MOEs ranging between 8800 and 190,000). Postapplication exposure risks for adults and toddlers were not of concern (MOEs ranging between 770 and 400,000). The toddler aggregate MOE for postapplication exposure risk was not of concern (MOE = 740). The ResSOPs ranged between median and high end assessments, and the use assessed was for spot treatment, not the entire lawn. Therefore, the residential postapplication exposure risk assessment should be considered conservative.

1.1 Purpose

This document addresses the occupational and residential exposure risks for the reregistration eligibility document (RED) and proposed new use for the pesticide chlorsulfuron.

1.2 Criteria for Conducting Exposure Assessments

An occupational and/or residential exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete. For chlorsulfuron, both criteria are met.

1.3 Summary of Toxicity Concerns Relating to Occupational/Residential Exposures

Table 1 presents the acute toxicity categories as outlined in the toxicity memorandum dated June 5, 2002 (HED Doc TXR NO. 0050783).

Table 1: Acute Toxicity of Chlorsulfuron

Guideline No.	Study Type	MRID #(s)	Results	Toxicity Category
81-1	Acute Oral	00031406	LD_{50} = 5.5/6.3 g/kg♪	IV
81-2	Acute Dermal	00083956	LD_{50} = 3400 mg/kg	III
81-3	Acute Inhalation	00086825	LC_{50} = 5.9 m/L	IV
81-4	Primary Eye Irritation	00031414√	not an eye irritant	IV
81-5	Primary Skin Irritation	00031417√	no adequate study	-
81-6	Dermal Sensitization	00031417√	no adequate study	-

♪ males/females; √classified unacceptable/nonguideline

Other Endpoints of Concern

The endpoints, and associated uncertainty factors, used in assessing the risks for chlorsulfuron were presented in Table 2 (*Chlorsulfuron - Report of the Hazard Identification Assessment Review Committee,* June 5, 2002). An additional 3X database uncertainty factor was used for residential exposure risks due to an incomplete database (lack of a 2-generation reproduction study, an acute neurotoxicity study, and a subchronic neurotoxicity study).

Table 2: Summary of Toxicology Endpoint Selection for Chlorsulfuron

Exposure Scenario	Dose (mg/kg/day) UF /MOE	Endpoint for Risk Assessment
Dietary Risk Assessments		
Incidental Oral Short-Term (1 - 30 Days) Residential only	NOAEL= **75 mg/kg/day** Target MOE = 300	**rabbit developmental toxicity** LOAEL = **200** mg/kg/day based on **decreased body-weight gain**.
Incidental Oral Intermediate-Term (1 - 6 Months) Residential Only	NOAEL= **75 mg/kg/day** Target MOE = 300	**rabbit developmental toxicity** LOAEL = **200** mg/kg/day based on **decreased body-weight gain**.
Non-Dietary Risk Assessments		
Dermal [a] Short-Term (1 - 30 days)	**Oral** NOAEL= 75 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	Same as above
Dermal [a] Intermediate-Term (1 - 6 Months)	**Oral** NOAEL= 75 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	Same as above
Dermal [a] Long-Term (> 6 Months)	**Oral** NOAEL= 2 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	**rat chronic toxicity/carcinogenicity** LOAEL = **30** mg/kg/day based on **decreased body-weight gain.**
Inhalation [b] Short-Term (1 - 30 days)	**Oral** NOAEL= 75 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	**Same as above, rabbit developmental toxicity**
Inhalation [b] Intermediate-Term (1 - 6 Months)	**Oral** NOAEL= 75 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	**Same as above, rabbit developmental toxicity**
Inhalation [b] Long-Term (>6 Months)	**Oral** NOAEL= 2 mg/kg/day Target Occupational MOE =100 Target Residential MOE = 300	**Same as above, chronic, rat chronic toxicity/carcinogenicity**
FQPA Uncertainty Factor	1x	
Cancer	**Classification:** no evidence of carcinogenicity	

a Since an oral NOAEL/LOAEL was selected, absorption *via* the dermal route is assumed to be equivalent to oral absorption (i.e., a dermal absorption factor of 1 was used).
b Since an oral NOAEL/LOAEL was selected, absorption *via* inhalation is assumed to be equivalent to oral absorption (i.e., a inhalation absorption factor of 1 was used).

1.4 Summary of Use Pattern and Formulations

At this time, products containing chlorsulfuron are intended for cereal grain, fallow field and lawn applications. Both occupational and residential uses have been assessed for exposure risks.

Type of Pesticide/Targeted Pest/Use Sites

Chlorsulfuron (2-chloro=N-(((4-methoxy-6 methyl-1,3,5-triain-2-yl)amino)carbonyl)

benzensulfonamide) is a herbicide currently registered for the control of grasses and broadleaf weeds. The current uses are on wheat, barley, fallow fields and lawns. The potential exposure risks for the proposed use on pastures and rangelands is also assessed within this document. Application rates vary between 0.0078 and 0.25 lb ai/A, depending on target species and use site. Table 3 contains the uses and proposed uses for chlorsulfuron.

Table 3: Summary of Chlorsulfuron Uses.

Crop	Proposed use: pastures and rangeland Registered Uses: wheat, barley, fallow fields, non-cropland and lawn
Formulation	Dry Flowable (water dispersible granule)
Pests	grasses
Application methods	groundboom sprayer, handheld sprayers and aerial application
Maximum application rates (AR)	Field: 1 oz ai (0.0625 lb)/Acre; Turf: 0.25 lb ai/A
Number of applications per season	2

2.0 OCCUPATIONAL EXPOSURES AND RISKS

Occupational Exposure

Based on early season (applied at germination or actively growing) use patterns, chronic exposure to chlorsulfuron is unlikely. Since no chemical specific data are available to assess potential exposure to pesticide handlers (i.e., mixer/loaders and applicators), the Pesticide Handlers Exposure Database (PHED, 1.1, 1998) is the basis for exposure calculations. Due to use pattern on crops with minimal worker tasks after application, no postapplication exposure is expected and no risk has been assessed.

2.1 Handler Exposures & Risks

Handler Exposure/Risk: The daily dermal exposure, daily dose and hence the risks, to handlers were calculated as described below. The first step was to calculate daily dermal exposure using the following formula:

Formula 1:

$$\text{Daily Dermal Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) = \text{Unit Exposure}\left(\frac{\text{mg ai}}{\text{lb ai}}\right) \text{x Application Rate}\left(\frac{\text{lb ai}}{\text{A}}\right) \text{x Daily Acres Treated}\left(\frac{\text{A}}{\text{day}}\right)$$

Where:

Daily Dermal Exposure=	Amount deposited on the surface of the skin that is available for dermal absorption, also referred to as potential dose (mg ai/day);
Unit Exposure =	Normalized exposure value derived from August 1998 PHED (mg ai/lb ai);
Application Rate =	Normalized application rate based on a logical unit treatment such as acres or gallons, a maximum value is generally used (lb ai/A);
Daily Acres Treated =	Normalized application area based on a logical unit treatment such as acres (A/day) or gallons per day can be substituted (gal/day).

Daily dermal dose was then calculated by normalizing the daily dermal exposure value by body weight and accounting for dermal absorption (i.e., a biologically available dose resulting from dermal exposure was then calculated). For adult handlers using chlorsulfuron, an average adult body weight of 70 kg was used for all exposure scenarios because all scenarios are occupational and the toxic effect was seen in males and females. Additionally, a dermal absorption factor of 100 percent was used for all dermal calculations. Daily dermal dose was calculated using the following formula:

Formula 2:

$$\text{Daily Dermal Dose}\left(\frac{\text{mg ai}}{\text{kg/day}}\right) = \text{Daily Dermal Exposure}\left(\frac{\text{mg ai}}{\text{day}}\right) \text{x} \left(\frac{\text{Dermal Absorption Factor}}{\text{BodyWeight}(kg)}\right)$$

The next step was to calculate inhalation exposure for handlers. The risk process used is similar to that used to calculate the daily dermal dose to handlers. Daily inhalation exposure levels are presented as (μg/lb ai) values in the PHED Surrogate Exposure Table of August 1998 (i.e., these values are based on an inhalation rate of 29 liters/minute and an 8 hour exposure interval). Once the unit exposure value is presented in this form and converted to (mg/lb ai), the calculations essentially mirror those presented above for the dermal route using a value of 100 percent absorption (i.e., a daily inhalation dose is calculated in mg/kg/day).

The handler exposure assessment does not include any dietary or drinking water inputs.

Finally, the calculations of daily dermal dose and daily inhalation dose received by handlers were then compared to the appropriate NOAEL to assess the total risk to handlers for each exposure route within the scenarios. Both dermal and inhalation short-term and intermediate-term MOEs were calculated using a NOAEL of 75 mg/kg/day, see Table 2, and the formula below:

Formula 3:

$$\text{MOE}_{\text{exposure route}} = \frac{\text{NOAEL}\left(\frac{\text{mg}}{\text{kg / day}}\right)}{\text{Total Daily Absorbed Dose}\left(\frac{\text{mg}}{\text{kg / day}}\right)}$$

A combined MOE was also calculated because the endpoints selected for dermal and inhalation exposure were from a single study. The following formula is used to combine the route specific MOEs:

Formula 4:

$$MOE_{total} = \frac{1}{[(1/MOE_{dermal}) + (1/MOE_{inhalation})]}$$

A margin of exposure (MOE) uncertainty factor of 100 is considered an appropriate risk level for both the short- and intermediate-term occupational exposures to chlorsulfuron. An MOE of 300 is considered appropriate for residential exposure risks.

Occupational handler exposure risk from the proposed use on rangeland and pastures is calculated based on the equipment being used. Equipment-based risk calculations are separated into scenarios according to the tasks, equipment and PHED. Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the reregistration of chlorsulfuron. It is the policy of the HED to use data from the Pesticide Handlers Exposure Database (PHED) Version 1.1 to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available (HED ExpoSAC Policy 007). The PHED data characterization is attached at the end of this document in Appendix A, Table A1.

The maximum application rate listed on the proposed use was used for all calculations. The standard values for acreage were taken from the HED Exposure SAC Policy 9.1 effective Sept. 25, 2001.

2.1.1 Handler Exposure Scenarios

Currently, HED recommends that the exposure and risk estimates for mixer/loaders and applicators of tractor drawn equipment remain separate unless specific chemical and/or crop information exists to warrant the combining of the two estimates. Therefore, scenarios applicable to mixing/loading and applying chlorsulfuron by groundboom were not included in the handler exposure assessment for the proposed uses. While HED realizes that each use could be mixed, loaded and applied by the same person, the studies in PHED did not monitor that type of product use. Combining of mixer/ loaders and applicator data from separate PHED scenarios is outside the scope of the database. For chlorsulfuron, the following PHED scenarios were used.

Mixer/Loaders: (M/L)

Scenario 1: Mixing and Loading Dry Flowable for Aerial Application (wheat, high acreage).
Scenario 2: Mixing and Loading Dry Flowable for Aerial Application (cereal grains, low acreage).
Scenario 3: Mixing and Loading Dry Flowable for Groundboom Application (cereal grains).
Scenario 4: Mixing and Loading Dry Flowable for Groundboom Application (grass areas).
Scenario 5: Mixing and Loading Dry Flowable for High Pressure Handwand Application (grass areas).

Applicators (APP)

Scenario 6: Sprays by Aerial Application (wheat).
Scenario 7: Sprays by Aerial Application (cereal grains).
Scenario 8: Sprays by Groundboom Application (wheat).
Scenario 9: Sprays by Groundboom Application (cereal grain).
Scenario 10: Sprays by High Pressure Handwand (cereal grains).

Scenario 11: Flagger for Aerial Application (cereal grains)

2.1.2 Data and Assumptions for Handler Exposure Scenarios

- Body weight of 70 kg, since the toxicological endpoint point is for the general population (not gender specific).

- Maximum rate per acre is used.

- 8 hour workday with a range of acres to account for varying equipment types and field size.

- Mixer and loaders of chemical are not also applying the chemical.

- Only baseline clothing scenario exposure risks were calculated since the MOEs for short-term exposures were well above the target MOE of 100. Not all registered labels contain the personal protective equipment requirements. Baseline clothing should be stated on the each label.

- All calculations are reported to two (2) significant figures which may result in rounding differences.

2.1.3 Handler Exposure and Non-Cancer Risk Estimates

The potential exposures and risks within the 11 identified exposure scenarios were assessed in this document using the toxicological endpoints and uncertainty factors associated with the active ingredient. The PHED data characterization is set out in Table A1 attached at the end of this document.

Table 4 provides short-term exposure risk calculations for handlers wearing baseline clothing, long sleeved shirt, long pants, socks and shoes. All route specific and combined MOEs are greater than the target MOE of 100 and therefore risks are not of concern (MOEs range between 1,000 and 56,000).

Table 4: Chlorsulfuron Handler Exposure: Baseline Clothing.*											
Scenario	Acres /day	Application Rate lb ai/A	Dermal Unit mg/lb ai	Inhalation Unit μg/lb ai	Dermal Exposure[a] mg/day	Dermal Dose[b] mg/kg/day	Inhalation Exposure[c] mg/day	Inhalation Dose[d] mg/kg/day	MOE[e]		
									Dermal	Inhalation	Combined[f]
Mixer/Loader											
1. Aerial Wheat	1200	0.0625	0.066	0.77	5.0	0.071	0.058	0.00083	1100	91000	1000
2. Aerial: Grain	350		0.066	0.77	1.4	0.021	0.017	0.00024	3600	310000	3600
3. Broadcast: Grain	200		0.066	0.77	0.83	0.0118	0.0096	0.00014	6400	550000	6300
4. Broadcast: Grasses	80	0.14	0.066	0.77	0.74	0.0110	0.0086	0.00012	7100	6.1e+05	7000
5. HPHW (x100 gal)	10		0.066	0.77	0.09	0.00130	0.00110	1.5e-05	57000	4.9e+06	56000
Applicator											
6. Aerial Wheat	1200	0.0625	0.0050	0.068	0.38	0.0054	0.0051	7.3 e -05	14000	1.0 e+06	14000
7. Aerial Grain	350		0.0050	0.11	0.11	0.0016	0.0015	2.1 e -05	48000	3.5 e+06	47000
8. Broadcast Wheat	200		0.014	0.74	0.18	0.0025	0.0093	0.00013	30000	570000	28000
9. Broadcast Grain	80	0.14	0.014	0.74	0.070	0.00100	0.0037	5.3e-05	75000	1.4e+06	32000
10. HPHW** (x100 gal)	10		1.8	79	1.13	0.016	0.049	0.00071	4700	110000	2000
11. Flagger Grain	350	0.0625	0.011	0.35	0.24	0.0034	0.0077	0.00011	22000	6.9e+05	21000

* Baseline clothing includes long sleeved shirt, long pants, socks and shoes. This table is generated with a spreadsheet program. The result of calculations are shown to 2 significant figures which may result in rounding differences.

** HPHW: High Pressure Handwand: spot treatments only (100*10 = 1000 gal use).

a Dermal Exposure (mg/day) = Acres/day *Application Rate (lb ai/A) * Dermal Unit (mg/lb ai).

b Dermal Dose (mg/kg/day) = [Dermal Exposure (mg/day) * Dermal Absorption (100% / 100%)] ÷ Body Weight (70 kg).

c Inhalation Exposure (mg/day) = Acres/day *Application Rate (lb ai/A) * Inhalation Unit (μg/lb ai) * Conversion (1mg/1000 μg).

d Inhalation Dose (mg/kg/day) = Inhalation Exposure (mg/day) *Inhalation Absorption (100% / 100%)÷ Body Weight (70 kg).

e (Inhalation or Dermal) MOEs (unitless) = NOAEL (75 mg/kg/day) ÷ Dose (Inhalation or Dermal). Target MOE = 100.

f` Combined MOE (unitless) = $\dfrac{1}{\dfrac{1}{MOE_{dermal}} + \dfrac{1}{MOE_{Inhalation}}}$ Target Combined MOE =100.

2.1.4 Handlers Exposure and Risk Estimates for Cancer

Chlorsulfuron was found to have no evidence of carcinogenicity, therefore no cancer risk assessment was completed.

2.1.5 Summary of Risk Concerns for Handlers, Data Gaps, and Confidence in Estimates

The potential exposure risk calculated for occupational handlers were not of concern (MOEs above the target value of 100). No chemical specific monitoring study, market data or use closure memo was available when this assessment was written. Each scenario was evaluated using PHED data and standard values according to HED practice and policy. Since standard values and PHED data were selected to represent median to high end risk, the assessment was considered to be conservative.

2.1.6 Recommendations

The PHED data used to conduct the exposure risk calculations were of mixed quality and grade. Due to the lack of chemical-specific monitoring data, application information and market trends, whether this assessment represents an over or underestimate of risk is unclear. Long-sleeved shirt, long pants socks and shoes should be listed on the label. It should be noted, however, that the lowest calculated handler MOE is 10X above the occupational target MOE of 100.

2.2 Post-Application Exposures & Risks

Due to use pattern and treated crops with minimal worker tasks, no postapplication exposure was expected and no risk assessment was conducted.

2.3 Occupational Risk Characterization

2.3.1 Handler Characterization

The calculations completed for this assessment were conservative. Information on market data, typical use patterns and chemical-specific monitoring studies would refine the risk assessment.

3.0 RESIDENTIAL AND OTHER NON-OCCUPATIONAL EXPOSURES AND RISKS

According to registered labels, chlorsulfuron can be used on lawns to control perennial "bunch or clump" grasses or other weeds. Since it is not a restricted chemical, residential/homeowner handlers can apply to lawn.

3.1 Residential Handler Exposure Scenarios and Risks

Chlorsulfuron use on lawns was assessed at maximum label rate for residential handler and postapplication exposure risk calculations. The use directions indicate spot treatment on turf with "a rate of 1.0 to 5.33 ounces per acre to cover 725 to 4000 sq. ft depending upon weed species."

This wording should be rewritten to be equivalent to 0.25 lb ai/ A or 0.0057 lb ai/1000 sq ft.. According to the registered formulations, chlorsulfuron is only marketed as a water dispersible granule. HED assumes only adult handlers applying pesticides in the residential environment.

Residential exposure risk was assessed using standard values and assumptions from the Residential Exposure Assessment Standard Operating Procedures (ResSOPs, September 1999). The ResSOPs were further described for use in risk assessments in HED Science Advisory Committee on Exposure (ExpoSAC) Revised Policy 012 (February 22, 2001). Residential handlers are assumed to be wearing short sleeved shirts, and short pants. The unit exposure values listed in the ResSOPs for common types of home equipment have varying degrees of "representativeness" depending on the PHED study monitoring protocol, the grade of data and confidence, details on data is set out in the attached Appendix, Table A2. The scenarios used for this exposure risk assessment are best available for uses of chlorsulfuron.

- Low Pressure Handwand: Mixer/loader/applicator
- Backpack Sprayer: Mixer/loader/applicator

Table 5 contains the results of residential handler exposure risk calculations; the risk for residential handlers is not of concern (MOE>300). .

Table 5: Residential Handler Exposure Risk for Chlorsulfuron: Turf Application

Product% AI	Rate of Product (oz/A)	**lb ai / 1000 ft^2 [a]**
75	5.33	**0.0057**
Spot treatment : Res SOPs;		

Handler	Dermal					Inhalation				Combined MOE[e]
	Unit (mg/lb ai)	Area Treated (ft^2)	Exposure[b] (mg/day)	Dose[c] (mg/kg/day)	MOE[d]	Unit (μg ai/lb)	Exposure[b] (mg/day)	Dose[c] (mg/kg/day)	MOE[d]	
Low Pressure Handwand	103.6	1000	0.59	0.01	8800	21.6	1.2e-03	1.8e-06	4.2e+07	8800
Garden: Backpack Sprayer	4.9		0.028	0.00040	190000	30	1.7e-04	2.5e-06	3.7e+07	190000

a Application Rate (lb ai / 1000 ft^2) = $\frac{5.33 \text{ oz product} * (75\%) * \text{lb}}{1\text{A} * 100\% * 16 \text{ oz}} * \frac{1A}{43.56 Ksqft}$

b Exposure (mg/day) = Unit (mg/lb ai or μg ai/lb) * Application Rate (lb ai / 1000 ft^2)* Area Treated [(ft^2)/ day] [* 1000 μg/mg conversion if necessary].

c Dose (mg/kg/day) = $\frac{\text{Exposure (mg/day)} * \text{Absorption Factor (Dermal or Inhalation)}}{\text{Body Weight (70 kg)}}$

Dermal and Inhalation Absorption Factor = 1 for Chlorsulfuron.

d MOE = $\frac{NOAEL(mg/kg/day)}{Dose(mg/kg/day)}$;

NOAEL = 75 mg/kg/day for short and intermediate dermal and inhalation exposures. Target MOE = 300.

e Combined MOE = $\frac{1}{\left(\frac{1}{MOEdermal} + \frac{1}{MOEinhalation}\right)}$ Target Combined MOE = 300.

3.1.1 Residential Cancer Risk

Chlorsulfuron was found to have no evidence of carcinogenicity, therefore no cancer risk assessment was completed.

3.2 Residential Postapplication Exposure Risk

Residential postapplication exposure to treated lawn was assessed for adults and toddlers. Standard values were used to represent the amount of applied ai available for exposure (percent dislodgeable), contact surface area, saliva extraction, events per hour, time per day and transfer coefficient (ExpoSAC policy 12). Residential pesticides were assumed to be contacted by adults and children on the day of application (DAT 0). According to the exposure risk calculations, presented in Table 6, postapplication exposure risk was not of concern (MOEs range between 770 and 400,000).

Toddler postapplication exposure was calculated for dermal and oral exposures. Since the incidental oral and dermal short-term endpoints were the same, the MOEs were combined in an aggregate MOE, as in formula 4. The aggregate MOE for postapplication toddler exposure risk was 740, therefore not a risk of concern (greater than residential target MOE of 300).

Table 6: Residential Postapplication Exposure Risk for Chlorsulfuron (Toddler and Adult).

Postapplication Residential Exposure Risk										
Postapp	Rate (lb ai/1000 ft^2)	Rate[a] (mg ai/cm^2)	Dislodgeable[b] (% of Applied)	Surface Area[b] (cm^2)	Saliva Extraction[b]	Events/hr[b]	Hours/day	Exposure[b] (mg/day)	Dose[c]	MOE[d]
Toddler										
Dermal	0.0057	0.0028	5%	5200	1	1	2	1.5	0.097	770
Hand to Mouth	0.0057	0.0028	5%	20	0.5	20	2	0.056	0.0037	20000
Object to Mouth	0.0057	0.0028	20%	25	1	1	1	0.014	0.00093	80000
Soil Ingestion	0.0057	0.0028	100%	1	1	1	1	0.0028	0.00019	400000
Adult										
Dermal	0.0057	0.0028	0.05	14500	N/A	N/A	2	4.1	0.058	1300

a Rate (mg ai/ cm^2) = Rate (lb ai/1000 ft^2) * 454000 (mg/lb) * 1 ft^2/ 929 cm^2.

b ResSOP, ExpoSAC Policy 12.

c Exposure (mg/day) = $\frac{\text{Rate (mg ai/cm2)} * \%\text{Dislodgeable}}{100\%} * SalivaExtraction * \frac{event}{hr} * \frac{hours}{day}$ * Contact Surface area (cm^2).

d Dose (mg/kg/day) = $\frac{\text{Exposure (mg / day)} * \text{Absorption Factor (Dermal)}}{\text{Body Weight (70 or 15 kg)}}$

Dermal and Inhalation Absorption Factor = 1 for Chlorsulfuron.

d MOE = $\frac{NOAEL(mg/kg/day)}{Dose(mg/kg/day)}$

NOAEL = 75 mg/kg/day for short and intermediate dermal exposures. Target Residential MOE = 300.

3.3 Residential Handler and Postapplication Assumptions

The following assumptions were used for the residential handler and postapplication exposure risk calculations. Most of these assumptions were taken from the ResSOPs and ExpoSAC policy 12 and were characterized as high-end assumptions (conservative).

* Maximum rate used on lawn spot treatment,
* Adult weighs 70 kg, toddler weighs 15 kg,
* Mixer/loader is adult and would also apply product,
* Contact with only treated turf on day of treatment,
* 5% of application rate available for transfer from treated turf to wet hands,
* Though ResSOP scenarios used are not "completely" representative of lawn applications by residential handler, they are the best available and conservative,
* The hand-to-mouth surface area has been defined by the SAP as 1 to 3 fingers (5.7 to 17.1 cm^2) a screening level of 20 cm^2 was selected based on the assumption that each hand-to-mouth event equals 3 fingers.
* The 1999 SAP recommended the use of the 90^{th} percentile value of hand to mouth events of 20 events per hour per Reed et al., (1999). Median reported in that study was 9.5 events.
* There is incomplete removal of residues on the hands water or saliva, for screening purposes, the value of 50% is recommended.
* 2 hours per day of playing outdoors on grass represents the 75^{th} percentile of time (EPA Exposure Factors Handbook).
* The object to mouth surface area represented a 2 x 2 inches or 25 cm^2 area and was intended to represent the approximate area from which a child may grasp a handful of grass or "mouth" an object such as a toy. HED believed this represents an upper-percentile value.
* The soil ingestion represents a child mouthing soil of which 1 cm^2 was freshly treated. This is considered high-end and conservative.

3.4 Residential Exposure Risk Characterization

The chlorsulfuron residential exposure risk assessment should be considered conservative. Use of chlorsulfuron in residential settings was not quantified by any source, however label language suggested minimal residential marketing. The ResSOP scenarios used to estimate potential exposure risk are "best fit" for uses of chlorsulfuron. It was not clear whether the calculated potential risks were an over or under estimate of risk for chlorsulfuron use in residential setting. Given the low use rates, minimal re-applications (60 day interval) and high end values from ResSOPs, this assessment should be considered conservative.

NOTE: Summary of Postapplication Spray Drift/Track-In Risks

HED has concerns for the potential for children's exposure in the home as a result of agricultural uses of chlorsulfuron. Environmental concentrations of chlorsulfuron in homes may

result from spray drift, track-in, or from redistribution of residues brought home on the farmworker's clothing. Potential routes of exposure for children may include incidental ingestion and dermal contact with residues on turf, carpets/hard surfaces.

The chlorsulfuron assessment reflects the Agency's current approaches for completing residential exposure assessments based on the guidance provided in the OPPTS Harmonized Guidelines, *Series 875-Occupational and Residential Exposure Test Guidelines, Group B-Postapplication Exposure Monitoring Test Guidelines*, the *Draft: Standard Operating Procedures (SOPs) for Residential Exposure Assessment*, and the *Overview of Issues Related to the Standard Operating Procedures for Residential Exposure Assessment* presented at the September 1999 meeting of the FIFRA Scientific Advisory Panel (SAP). The Agency is, however, currently in the process of revising its guidance for completing these types of assessments. Further research into children's exposures resulting from agricultural uses of pesticides are being conducted by the Agency's Office of Research and Development through the STAR (Science to Achieve Results) grant program. The STAR program can be accessed at ***http://es.epa.gov/ncerqa/grants/*** Modifications to this assessment shall be incorporated as updated guidance becomes available. This will include expanding the scope of the residential exposure assessments by developing guidance for characterizing exposures from other sources not addressed such as from spray drift and exposures to farm worker children.

Conclusion

The registered and new use of chlorsulfuron on rangeland and pastures do not have calculated exposure risks of concern (MOEs ≥ occupational target of 100). Baseline clothing should be stated on label, and some label language simplification on application rates would clarify spot treatment rates. Though standard values and assumptions were used to calculate exposure risks in occupational and residential scenarios, the values are considered as screening level and conservative.

Appendix A
PHED 1.1 and ResSOP Data
Characterization and Evaluation

Table A1: PHED Data Confidence, Grade and Unit Exposure Values.

Exposure Scenario (Number)	Standard Assumptions	Dermal Unit Exposure mg of exposure /lb ai handled	Inhalation Unit Exposure μg of exposure / lb ai handled	Comments[a]
Mixer/Loader				
Aerial (1), (2)	350 (low acreage) 1200 (high acreage)	0.067	0.77	Baseline Clothing Single layer, long sleeved shirt and long pants with GLOVES Baseline: Dermal = 16 replicates, AB grade, Hand = 21 replicates, AB grade. Note: this run has a lot of non-detects for the glove exposure values. **High** Confidence. [Single layer no gloves has the same Dermal Unit Exposure] Inhalation = 23 replicates, AB grade. **High** Confidence.
Groundboom (3), (4)	80 (low acreage) 200 (high acreage)			
High-Pressure Handwand (5)	1000 gallons per day use			
Applicators				
Aerial Application (6), (7)	350 (low acreage) 1200 (high acreage)	0.0050	0.068	Aerial Fixed Wing with Enclosed Cockpit/Liquid Application Baseline Clothing: Single layer, long sleeved shirt, long pants , no gloves. This scenario is considered an Engineering Control due to the Enclosed Cockpit: Dermal replicates = 24 to 48, ABC grade. Hand replicates = 34. AB grade. **Medium** Confidence due to poor grade quality. Inhalation = 23 replicates. ABC grade. **Medium** Confidence due to poor grade quality.
Groundboom Application (8), (9)	80 (low acreage) 200 (high acreage)	0.014	0.74	Baseline Clothing. Single layer clothes, long sleeved shirt, long pants and No Gloves. Baseline: Dermal = 23 to 42 replicates, AB grade. Hand replicates = 21, AB grade. The neck location is limited to 23 observations, the next lowest number of observations is 32. **High** Confidence. Inhalation = 22 replicates, AB grade. **High** Confidence.
High-Pressure Handwand Application (10)	1000 gallons per day use	1.8	79	Baseline Clothing: single layer, long sleeved shirt, long pants and No gloves. Baseline: Dermal = 9 to 11 replicates, All grades. Hand Replicates = 2, All grade. **Low** Confidence due to inadequate replicate number and poor grade quality Inhalation = 11 replicates, All grade. **Low** confidence due to low replicate number and poor grade quality.
Flagger (11)	350 acres	0.011	0.35	Baseline Clothing: single layer, long sleeved shirt, long pants and No gloves. Baseline: Dermal = 18 to 28 replicates, AB grade. Hand = 30 replicates, AB grade. **High** Confidence. Inhalation = 28 replicates, AB grade **High** Confidence.

Table A2: ResSOP Data Confidence, Grade and Unit Exposure.

Exposure Scenario	Standard Assumptions	Dermal Unit Exposure mg of exposure /lb ai handled	Inhalation Unit Exposure μg of exposure / lb ai handled	Comments[a]
Low Pressure Handwand	Spot Treatment: 1000 sq ft	103.6	21.6	Dermal replicates = 8 or 9, ABC grade. Hand Replicates = 70, All grades. Low Confidence run. No protection factors were necessary. Inhalation Exposure, 80 Replicates, ABC Grade. ("other" distribution type, median value reported). Medium Confidence. NOTE: This scenario is representative of treating low to mid level shrubs. This scenario is not, however, completely representative of homeowners using a low pressure handwand sprayer to apply pesticides indoors and to lawns, gardens or to trees. These data were generated by test subjects using a typical low pressure handwand to treat low and mid-level targets generally below the waist (e.g., shrubs and greenhouse benches)l For those exposure scenarios representing applications above the waist, the unit exposure value may underestimate exposure to the head and upper body (e.g., tree applications).
Garden: Backpack Sprayer		4.9	30	Dermal replicates = 9 to 11, AB grade. Hand replicates =11. C grade. Low Confidence run due to the inadequate replicate number. "No Glove" hand data are unavailable for this use scenario. The only way to estimate total dermal exposure is to "back calculate" the gloved hand exposure using a 90 percent protection factor. Inhalation Replicates = 11, A grade. Low confidence due to inadequate replicate number. NOTE: This scenario is representative of treating low to mid level shrubs. This scenario is not , however, completely representative of homeowners using a backpack sprayer to apply pesticides to lawns, gardens or to trees. These data were generated by test subjects using a typical backpack sprayer to treat low to mid level targets generally below the waist (e.g., greenhouse benches). For those exposure scenarios representing applications above the waist, the unit exposure value may underestimate exposure to the head and upper body (e.g., tree applications).