INITIAL REVIEW ENGINEERING REPORT [redacted]
PMN: 22-0054

Scoping Ready 10/3/2022
ENGINEER: Al-Haddad \ NB
PV (kg/yr): [redacted] Import Only
SUBMITTER: [redacted]
USE: Intended use: [redacted]
P2REC: CRSS: Forward. P2 Claim: [redacted]
Analogues (same use): None found.
Patents (same use): None found.
OTHER USES: Analogues (other use): [redacted]
Analogues (same and other use): None found.
Patents (other use): None found.

MSDS: Yes Label: No

Gen Eqpt: goggles, face shield, safety glasses (with side protection) // impervious gloves and protective clothing (body suit) // High ventilation/fume hoods
Respirator: If needed
Health Effects: Harmful if swallowed. Causes skin irritation. May cause allergic skin reaction. Causes serious eye irritation. May cause respiratory irritation
TLV/PEL:
none established

CRSS (03/24/2022):
Chemical Name: Graphene
S-H20: 1E-06 g/L @
VP: 1.0E-6 torr @
MW: [redacted].00 0.00%<500 0.00%<1000
Physical State and Misc CRSS Info:
Neat: Solid Mfg: NK: Import Proc/Form: Imported as Dispersion: [redacted] PMN material in [redacted], then Dispersion: [redacted] PMN material in coating formulation End Use: Solid: PMN material entrained in cured coating. The structure drawn is representative. The molecular weight is variable and depends on the particle size. It is expected to be [redacted] g/mole. The PMN material is described as folded individual platelets which form agglomerated graphene nanoplatelets in [redacted] The composition of the PMN substance was determined by X-Ray Photoelectron Spectroscopy Analysis: 97.1% Carbon, 2.8% Oxygen, 0.1% Sodium.
Submitted Properties: MP = [redacted] °C (Sub. Est.); WS = Insoluble; Density = [redacted] g/cc (Sub. Est.); Flake Number of Layers = 6-18 (mean 12); Thickness = 3-6 nm (mean 4 nm) by AFM; Lateral Flake Size = 340-2,960 nm (median 1,010 nm) by SEM; Non-Graphitic vs. Graphitic Carbon Ratio = 0.07 by XPS; Graphitic Percentage = 28% by XRD; BET Surface Area = 275 m^2/g; Agglomerated Particle Size: D90 = [redacted] µm.
Raman, XRD, AFM, SEM, and XPS results are provided in the submission.
Properties Submitted in [redacted]: Black/grey solid; MP >[redacted] °C (Sub. Est.); Average platelet thickness = 4 nm, Range = 3-6 nm; Median lateral flake size = 1010 nm, Range = 340-2960 nm; Particle size distribution (Platelet lateral size, Dynamic light scattering analysis): D90 [redacted] microns, D50 [redacted] microns, D10 [redacted] micron; BET surface area = 180-284 m2/g. XPS, XRD, SEM, and AFM microscopy studies are included the submission.
Estimated properties: VP < 0.000001 torr (High MW); WS < 0.000001 g/L (Highly hydrophobic).
Consumer Use: [redacted]
SAT (concerns) :

[redacted]

Migration to groundwater: null null
PBT rating: P0B0T0
Health:
Eco:

OCCUPATIONAL EXPOSURE RATING: 1-2D

NOTES & KEY ASSUMPTIONS:
Occupational exposure and environmental releases were estimated using ChemSTEER v3.2 (5/12/2016). Input to ChemSTEER tool includes information from: the submission, physical / chemical properties, and relevant past cases. NCS is import only, thus no MFG operation is assessed. // One same submitter, similar use past case was identified: [redacted]. Two different submitter, similar use past cases were also referenced for consistency: [redacted]. // PROC: This IRER assesses releases from container and equipment cleaning residuals (consistent with [redacted]). // USE: This IRER assesses releases from container cleaning (consistent with [redacted]), equipment cleaning (consistent with [redacted]), and [redacted] (consistent with [redacted]).

POLLUTION PREVENTION CONSIDERATIONS:

P2 Claim: [redacted]

[redacted]

EXPOSURE-BASED REVIEW: [redacted]

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PROC: [redacted]

Number of Sites/ Location: [redacted]

Days/yr: [redacted]

Basis: Submission specifies [redacted] sites, which NCD assumes is meant to represent the number of USE sites. Submission attachment A16 specifies [redacted] kg NCS at [redacted] concentration ([redacted] kg raw material) is used per batch, and specifies [redacted] batches per year. Submission also specifies [redacted] exposure days/year.

Assessing [redacted] bt/site-yr (consistent with [redacted] exposure days/yr), [redacted] NCS in raw material, and [redacted] kg raw material/bt results in [redacted] sites. Per engineering judgement, formulation likely occurs at much fewer sites. NCD assesses standard [redacted] operating days/year ([redacted] bt/site-day). CS calculates [redacted] sites with rounding error; NCD re-assessed [redacted] sites, [redacted] days/batches per year, and [redacted] NCS. CS calculates [redacted] kg raw material/bt ([redacted] kg NCS/bt).

Process Description: [redacted] (per submission and CRSS)

*Note: [redacted]% of NCS is [redacted] NCD did not assess this application method.

ENVIRONMENTAL RELEASES ESTIMATE SUMMARY

IRER Note: The daily releases listed for any source below may coincide with daily releases from the other sources to the same medium. // NCD assesses incineration as release media per the submission, as it's assumed that formulation site operations are known by the submitter (even though explicit sites are not identified).

Incineration releases:
Incinerator type: hazardous waste
Particle Size: n/a (vapor)
Cyclical or consecutive: unknown
Release Duration: unknown

Incineration
High End: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: off-site incineration (per submission)
from: Cleaning Liquid Residuals from Drums Used to Transport the Raw Material
basis: EPA/OPPT Drum Residual Model, CEB standard 3% residual. Submission states that [redacted]; this estimate is less than NCD's standard model. The submission did not provide a basis for this estimate, thus NCD estimates 3% residual per the standard model, released to off-site incineration (per submission).

Incineration
Output 2: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: off-site incineration (per submission)
from: Equipment Cleaning Losses of Liquids from a Single, Large Vessel
basis: User-Defined Loss Rate Model. Submission estimates [redacted]; this exceeds the standard model for single vessel equipment cleaning. Thus, NCD assesses 2% residual to off-site incineration (per submission).

RELEASE TOTAL
[redacted] kg/yr - all sites

OCCUPATIONAL EXPOSURES ESTIMATE SUMMARY
Tot. # of workers exposed via assessed routes: [redacted]
Basis: Submission specifies [redacted] exposed workers (Activities A-C; NCD assumes this is per site), but attachment A16 specifies [redacted] NCD assesses [redacted] exposed workers/site as conservative

Inhalation:

negligible (VP < 0.001 torr); no mist/aerosol generation expected.

Dermal:

INITIAL REVIEW ENGINEERING REPORT [redacted]

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USE: [redacted]

Number of Sites/ Location: [redacted]

unknown site(s)

Days/yr: [redacted]

Basis: Submission specifies [redacted] sites (Attachment A16), [redacted] NCS, and [redacted] exposure days/year. Per engineering judgement, USE likely occurs just as frequently if not more frequently than PROC (assessed at [redacted] days/yr).

Thus, NCD assesses standard [redacted] operating days/year ([redacted] bt/site-day). CS calculates [redacted] kg paint/bt ([redacted] kg NCS/bt).

Process Description: [redacted] (per submission and CRSS)

*Note: [redacted]% of NCS is used in [redacted] NCD did not assess this application method.

ENVIRONMENTAL RELEASES ESTIMATE SUMMARY

IRER Note: The daily releases listed for any source below may coincide with daily releases from the other sources to the same medium. // Submission states media is hazardous waste incineration, same as PROC, however due to large number of unknown sites NCD assesses media as uncertain.

Air/Incineration releases:
Incinerator type: hazardous waste
Particle Size: n/a (vapor)
Cyclical or consecutive: unknown
Release Duration: unknown

Water or Incineration or Landfill
Output 2: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: uncertain
from: Cleaning Liquid Residuals from 1-gal Cans Used to Transport the Raw Material
basis: User-Defined Loss Rate Model. Submission attachment A16 specifies [redacted]; this exceeds NCD's standard model. Thus, NCD assesses 2% residual released to uncertain media.

Water or Incineration or Landfill
Conservative: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: uncertain
from: Equipment Cleaning Losses of Liquids
basis: EPA/OPPT Multiple Process Vessel Residual Model, CEB standard 2% residual. Submission attachment A16 specifies [redacted] combined these are less than the standard model. Submission did not provide a basis for this low residual, thus NCD assesses standard model 2% LF to uncertain media.

Air
Typical: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
Worst Case: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: air (4%); incineration or landfill (96%) (per model)
from: Coating Using Hand-Held Spray Gun
basis: EPA/OPPT Automobile Refinish Coating Overspray Loss Model (non-volatiles). Submission specifies [redacted]. Submission does not provide a basis for this residual, thus NCD assesses the standard model.

Incineration or Landfill
Typical: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
Worst Case: [redacted] kg/site-day over [redacted] days/yr from [redacted] sites
or [redacted] kg/site-yr from [redacted] sites or [redacted] kg/yr-all sites
to: air (4%); incineration or landfill (96%) (per model)
from: Coating Using Hand-Held Spray Gun
basis: EPA/OPPT Automobile Refinish Coating Overspray Loss Model (non-volatiles). Submission specifies [redacted]. Submission does not provide a basis for this residual, thus NCD assesses the standard model.

RELEASE TOTAL
[redacted] kg/yr - all sites

OCCUPATIONAL EXPOSURES ESTIMATE SUMMARY
Tot. # of workers exposed via assessed routes: [redacted]
Basis: Submission specifies [redacted] exposed workers/site.

Inhalation:

Exposure to Particulate (non-volatile) (Class I)
Aircraft Booth:
> Potential Dose Rate: [redacted] mg/day over [redacted] days/yr
> Air conc, duration: [redacted] mg/m3 for [redacted] hr/day
> Lifetime Average Daily Dose: [redacted] mg/kg-day over [redacted] days/yr
> Average Daily Dose: [redacted] mg-kg/day over [redacted] days/yr
> Acute Potential Dose: [redacted] mg-kg/day over [redacted] days/yr
Small Parts Booth:
> Potential Dose Rate: [redacted] mg/day over [redacted] days/yr
> Air conc, duration: [redacted] mg/m3 for [redacted] hr/day
> Lifetime Average Daily Dose: [redacted] mg/kg-day over [redacted] days/yr
> Average Daily Dose: [redacted] mg-kg/day over [redacted] days/yr
> Acute Potential Dose: [redacted] mg-kg/day over [redacted] days/yr
Number of workers (all sites) with inhalation exposure: [redacted]
Basis: Coating Using Hand-Held Spray Gun; User-defined Inhalation Model. Submission attachments A6 and A10 present TWA exposure concentrations (along with calculations deriving said TWAs) for two scenarios: multiple workers spray painting an aircraft in a large booth, and [redacted] worker spraying aircraft parts in a small booth. These TWAs are only for respirable particulate fraction (<10 um); total particulate exposure estimates are not provided. Cm = 0.0364 um/m3 for aircraft booth, 0.158 um/m3 for small part booth.
NOTE: The respirator class is: I. Particulate (including solid or liquid droplets).

INHALATION MONITORING DATA REVIEW

1) Uncertainty (estimate based on model, regulatory limit, or data not specific to industry): Yes
2)a) Exposure level > 1 mg/day? No
OR
b) Hazard Rating for health of 2 or greater? No
=> Inhalation Monitoring Data Desired? **No**

Dermal: