DOCUMENT COVER SHEET

DOCUMENT NO.	REVISION	PAGE	OPEN ITEMS
UKP-GW-GL-037	3	1 of 24	N

DOCUMENT STATUS: **DES**	**AP1000** SAFETY CLASS: **NA**	Westinghouse Acceptance of **AP1000** Design Partner Document by:
LICENSING REVIEW STATUS: Completed and Attached		N/A (Print Full Name)
PLANT APPLICABILITY:		(Signature/Date)
☐ All **AP1000** Plants except:	☒ Only the following plants: UKP	

ALTERNATE DOCUMENT NUMBER: N/A

ORIGINATING ORGANIZATION: Westinghouse Electric Company, LLC

TITLE: Applicability of COMAH Regulations

DCP/DCA/SUPPLEMENTS/EDCR # INCORPORATED IN THIS DOCUMENT REVISION:
N/A

ATTACHMENTS:
UKP-GW-GL-037 Rev 3_ADL

PARENT DOCUMENT: N/A

LEGAL REVIEW Colleen T. Grygier	SIGNATURE / DATE (If processing electronic approval select option) Colleen T. Grygier 3/10/2017 [redacted] BNF 3/13/17
PATENT REVIEW Douglas E. Ekeroth	SIGNATURE / DATE **Electronically Approved*** **

ORIGINATOR(S) **W2-6.1-100.pdf** Bryan N. Friedman	SIGNATURE / DATE (If processing electronic approval select option) **Electronically Approved*** **	
REVIEWER(S) **W2-6.1-100.pdf** N/A	SIGNATURE / DATE	
	SIGNATURE / DATE	
	SIGNATURE / DATE	
VERIFIER(S) **W2-6.1-100.pdf** Adam D. Malinowski	SIGNATURE / DATE **Electronically Approved*** **	Verification Method: **Independent Review**
APPLICABILITY REVIEWER N/A	SIGNATURE / DATE	
RESPONSIBLE MANAGER* **W2-6.1-100.pdf** Jason J. Eisenhauer	SIGNATURE / DATE **Electronically Approved*** **	

**Approval of the responsible manager signifies that the document and all required reviews are complete, the appropriate proprietary class has been assigned, electronic file has been provided to the EDMS, and the document is released for use.*

******Electronically approved records are authenticated in the electronic document management system.***

****** Electronically approved records are authenticated in the electronic document management system. This record was final approved on Mar-13-2017. (This statement was added by the EDMS system to the quality record upon its validation.)***

UKP-GW-GL-037
Revision 3

March 2017

Applicability of COMAH Regulations

Westinghouse Electric Company LLC
1000 Westinghouse Drive
Cranberry Township, PA 16066, USA

REVISION HISTORY

Revision	Description of Changes
0	See EDMS
1	See EDMS
2	See EDMS
3	Licensing Basis Review completed and attached to ADL form per UKP-GW-GAP-147, Revision 0. The licensing basis review contains a review of the current UK Licensing Basis Documentation and has determined an impact to the Environment Report (UKP-GW-GL-790, Revision 6). The impact to UKP-GW-GL-790, Revision 6 is provided in UKP-GW-GL-037, Rev 3_ADL. The following changes are documented within UKP-GW-GL-037, Rev 3_ADL: • Minor editorial and formatting edits made throughout (not shown with revision bars). • Updated the term "top-tier" to "upper tier" throughout the document due to nomenclature differences within the updated COMAH regulation documentation. This is considered "administrative" by nature. • Updated Table 4-3 within document to include the full weight of the solutions containing the chemicals for comparison to the COMAH limits. For example, 35% hydrazine in solution requires the full 100% weight of the hydrazine and water for comparison to the limits. This update provides compliance with COMAH Regulations Schedule 1, Part 3, which discusses that mixtures must be treated in the way of pure substances. Additionally, in Schedule 1, Part 2, named substance 33 specifically states "carcinogens at concentrations above 5% by weight." • Updated Table 4-3 by adding Note 1, which discusses the use of densities for the substances which are not 100% by weight. These were estimated using supplier datasheet information for the solutions, and small margins of error from the densities are determined to not be a "cliff edge" effect for the comparison to the COMAH threshold limits. Therefore, these density estimations are concluded to be adequate. • Section 5 has been updated to describe that the AP1000 plant site is an upper tier COMAH site because of the proposed hydrazine inventory.

TABLE OF CONTENTS

Section	Title	Page
REVISION HISTORY		3
LIST OF ACRONYMS		5
1.	INTRODUCTION	6
2.	COMAH SUBSTANCES	6
3.	CHEMICALS STORED AT TYPICAL AP1000 PLANT	13
4.	APPLICABILITY OF COMAH TO AP1000 PLANT Design	16
5.	SUMMARY AND CONCLUSIONS	23
6.	REFERENCES	24

LIST OF TABLES

Table 2-1: HSE Named COMAH Substances 7

Table 2-2: HSE Categories of Substances and Preparations not Specifically Named 11

Table 3-1: Inventories on AP1000 Plant Turbine Island 14

Table 3-2: Inventories on AP1000 Plant Nuclear Island 15

Table 3-3: Chemical Inventory on Seawater Cooling System 15

Table 4-1: AP1000 Plant Dangerous Substance Categories 17

Table 4-2: Risk Phrases 19

Table 4-3: Comparison of AP1000 Plant Design with COMAH Regulations 21

LIST OF ACRONYMS

COMAH	Control of Major Accident and Hazard Regulations
CFS	Turbine Island Chemical Feed System
DOS	Standby Diesel Fuel Oil System
FPS	Fire Protection System
GDA	Generic Design Assessment
HSE	Health and Safety Executive
LPG	Liquefied Petroleum Gas
MAPP	Major Accident Prevention Policy
PGS	Plant Gas System
SE	Single Exposure
STOT	Single Target Organ Toxicity
UK	United Kingdom
US	United States
VWS	Central Chilled Water System

1. INTRODUCTION

The United Kingdom (UK) nuclear regulators have developed a Generic Design Assessment (GDA) process for evaluating alternative designs for the next generation of nuclear power plants to be built in the UK. Initially, the regulators review the safety, security, and environmental impact of the nuclear power plant designs against a generic site, which, as far as possible, will envelop or bound the characteristics of any potential UK site.

An important issue for the regulators is whether the storage of hazardous chemicals on the Westinghouse AP1000 plant design will fall within the Control of Major Accident and Hazard (COMAH) regulations (Reference 1). This has been assessed for previous versions of the COMAH regulations in prior revisions of this report, but is being reassessed for the newest version in this revision.

This report identifies the maximum inventory of the chemicals used on the AP1000 plant site. The chemical inventories are compared against the COMAH specified thresholds of dangerous substances to determine whether the AP1000 plant falls within the scope of COMAH regulations.

2. COMAH SUBSTANCES

The COMAH guidance specifies threshold quantities of dangerous substances that bring establishments within the scope of COMAH regulations. Two thresholds are defined: a lower-tier and an upper-tier.

If the lower-tier is exceeded, operators must notify the competent authority, and take all measures necessary to prevent major accidents and report any that do occur. Operators of lower-tier sites must also prepare a Major Accident Prevention Policy (MAPP).

If the upper-tier threshold is exceeded, operators must submit a substantial written safety report and provide emergency planning requirements. Before an upper-tier site is constructed, information must be submitted for approval from the competent authority. Application fees and regulatory cost recovery are higher for an upper tier site than for a lower tier site.

The Health and Safety Executive (HSE) listed dangerous substances, with associated lower and upper tier thresholds, to which the COMAH regulations apply as given in Table 2-1 (Schedule 1, Part 2, of Reference 1). Substances that are not specifically listed may fall into a dangerous substance category, as shown in Table 2-2 (Schedule 1, Part 1, of Reference 1).

Table 2-1: HSE Named COMAH Substances		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
Ammonium nitrate – Fertilisers capable of self-sustaining decomposition	5,000 (5,512)	10,000 (11,023)
Ammonium nitrate – Fertiliser grade	1,250 (1,378)	5,000 (5,512)
Ammonium nitrate – Technical grade	350 (386)	2,500 (2,756)
Ammonium nitrate – Off-spec material and fertilisers not satisfying the detonation resistance test	10 (11)	50 (55)
Potassium Nitrate (Composite potassium nitrate-based fertilisers composed of potassium nitrate in prilled/granular form)	5,000 (5,512)	10,000 (11,023)
Potassium Nitrate (Composite potassium nitrate-based fertilisers composed of potassium nitrate in crystalline form)	1,250 (1,378)	5,000 (5,512)
Arsenic pentoxide, arsenic (V) acid and/or salts	1 (1.1)	2 (2.2)
Arsenic trioxide, arsenious (III) acid and/or salts	-	0.1 (0.11)
Bromine	20 (22)	100 (110)
Chlorine	10 (11)	25 (28)
Nickel compounds in inhalable powder form (nickel monoxide, nickel dioxide, nickel sulphide, trinickel disulphide, dinickel trioxide)	-	1 (1.1)
Ethyleneimine	10 (11)	20 (22)
Fluorine	10 (11)	20 (22)
Formaldehyde (concentration ≥ 90%)	5 (6)	50 (55)

Table 2-1: HSE Named COMAH Substances		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
Hydrogen	5 (6)	50 (55)
Hydrogen chloride (liquefied gas)	25 (28)	250 (276)
Lead alkyls	5 (6)	50 (55)
Liquefied extremely flammable gases (including LPG) and natural gas (whether liquefied or not)	50 (55)	200 (220)
Acetylene	5 (6)	50 (55)
Ethylene oxide	5 (6)	50 (55)
Propylene oxide	5 (6)	50 (55)
Methanol	500 (551)	5,000 (5,512)
4, 4'-Methylenebis (2-chloraniline) and/or salts, in powder form	-	0.01 (0.011)
Methylisocyanate	-	0.15 (0.17)
Oxygen	200 (220)	2,000 (2,205)
Toluene diisocyanate	10 (11)	100 (110)
Carbonyl dichloride (phosgene)	0.3 (0.33)	0.75 (0.83)
Arsenic trihydride (arsine)	0.2 (0.22)	1 (1.1)
Phosphorus trihydride (phosphine)	0.2 (0.22)	1 (1.1)

Table 2-1: HSE Named COMAH Substances		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
Sulphur dichloride	-	1 (1.1)
Sulphur trioxide	15 (17)	75 (83)
Polychlorodibenzofurans and polychlorodibenzodioxins (including TCDD), calculated in TCDD equivalent	-	0.001 (0.0011)
The following CARCINOGENS or the mixtures containing the following carcinogens at concentrations above 5% by weight: Aminobiphenyl and/or its salts, Benzotrichloride, Benzidine and/or salts, Bis (chloromethyl) ether, Chloromethyl methyl ether, 1,2-Dibromoethane, Diethyl sulphate, Dimethyl sulphate, Dimethylcarbamoyl chloride, 1,2-Dibromo-3-chloropropane, 1,2-Dimethylhydrazine, Dimethylnitrosamine, Hexamethylphosphoric triamide, Hydrazine, 2-Naphthylamine and/or salts, 4-Nitrodiphenyl, and 1,3 Propanesultone	0.5 (0.55)	2 (2.2)
Petroleum products: (a) gasolines and naphthas (b) kerosenes (including jet fuels) (c) gas oils (including diesel fuels, home heating oils and gas oil blending systems) (d) heave fuel oils (e) alternative fuels serving the same purposes and with similar properties as regards flammability and environmental hazards as the products referred to in points (a) to (d)	2,500 (2,756)	25,000 (27,558)
Anhydrous ammonia	50 (55)	200 (220)
Boron triflouride	5 (6)	20 (22)
Hydrogen sulphide	5 (6)	20 (22)
Piperidine	50 (55)	200 (220)

Table 2-1: HSE Named COMAH Substances		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
Bis(2-dimethylaminoethyl) (methyl)amine	50 (55)	200 (220)
3-(2-Ethylhexyloxi)propylamine	50 (55)	500 (551)
Mixtures of sodium hypochlorite classified as Aqua Acute Category 1 (H400) – containing less than 5% active chlorine and not classified under other hazard categories in Schedule Part 1 and assuming that, in the absence of sodium hypochlorite, the mixture would not be classified as Aquatic Acute Category 1 (H400)	200 (220)	500 (551)
Propylamine	500 (551)	2,000 (2,205)
Tert-butyl acrylate	200 (220)	500 (551)
2-Methyl-3-butenenitrile	500 (551)	2,000 (2,205)
Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione (Dazomet)	100 (110)	200 (220)
Methyl acrylate	500 (551)	2,000 (2,205)
3-Methylpyridine	500 (551)	2,000 (2,205)
1-Bromo-3-chloropropane	500 (551)	2,000 (2,205)

Table 2-2: HSE Categories of Substances and Preparations not Specifically Named		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
Section 'H' – HEALTH HAZARDS		
H1 - ACUTE TOXIC (Category 1, all exposure routes)	5 (5.5)	20 (22)
H2 - TOXIC (Category 2, all exposure routes) (Category 3, inhalation exposure route)	50 (55)	200 (220)
H3 – STOT SE (SPECIFIC TARGET ORGANIC TOXICITY – SINGLE EXPOSURE) Category I	50 (55)	200 (220)
Section 'P' – PHYSICAL HAZARDS		
P1a – EXPLOSIVES a.) Unstable explosives or b.) Explosives, Division 1.1, 1.2, 1.3, 1.5, or 1.6 or c.) Substances or mixtures which have explosive properties according to method A.14 of Reference 2 and do not belong to the hazard classes Organic peroxides or Self-reactive substances and mixtures.	10 (11)	50 (55)
P1b – EXPLOSIVES Explosives, Division 1.4	50 (55)	200 (220)
P2 – FLAMMABLE GASES Flammable gases, Category 1 or 2	10 (11)	50 (55)
P3a – FLAMMABLE AEROSOLS 'Flammable" aerosols Category 1 or 2, containing flammable gases Category 1 or 2 or flammable liquids Category 1	150 (165) (net)	500 (551) (net)
P3b – FLAMMABLE AEROSOLS 'Flammable' aerosols Category 1 or 2, not containing flammable gases Category 1 or 2 nor flammable liquids category 1	5,000 (5,512) (net)	50,000 (55,116) (net)
P4 – OXIDISING GASES Oxidising Gases, Category 1	50 (55)	200 (220)
P5a – FLAMMABLE LIQUIDS a.) Flammable liquids, Category 1 b.) Flammable liquids, Category 2 or 3 (maintained at temperatures above their boiling points), or c.) Other liquids with a flash point less than ≤ 60°C (140°F) (maintained at a temperature above their boiling point)	10 (11)	50 (55)

Table 2-2: HSE Categories of Substances and Preparations not Specifically Named		
Dangerous Substances	**Lower-Tier Site**	**Upper-Tier Site**
	Quantity in tonnes (short tons)	
P5b – FLAMMABLE LIQUIDS a.) Flammable liquids Category 2 or 3 where particular processing conditions, such as high pressure or high temperature, may create major accidents, or b.) Other liquids with a flash point ≤ 60°C (140°F) where particular processing conditions, such as high pressure or high temperature, may create major accident hazards.	50 (55)	200 (220)
P5c – FLAMMABLE LIQUIDS Flammable liquids, Categories 2 or 3 not covered by P5a and P5b	5,000 (5,512)	50,000 (55,116)
P6a – SELF-REACTIVE SUBSTANCES AND MIXTURES and ORGANIC PEROXIDES Self-reactive substances and mixtures, Type A or B or organic peroxides, Type A or B	10 (11)	50 (55)
P6b – SELF-REACTIVE SUBSTANCES AND MIXTURES and ORGANIC PEROXIDES Self-reactive substances and mixtures, Type C, D, E, or F, or organic peroxides, Type C, D, E, or F	50 (55)	200 (220)
P7 – PYROPHORIC LIQUIDS AND SOLIDS a.) Pyrophoric liquids, Category 1 b.) Pyrophoric solids, Category 1	50 (55)	200 (220)
P8 – OXIDISING LIQUIDS AND SOLIDS a.) Oxidising Liquids, Category 1, 2, or 3 b.) Oxidising Solids, Category 1, 2, or 3	50 (55)	200 (220)
Section ‘E’ – ENVIRONMENT HAZARDS		
E1 – Hazardous to the Aquatic Environment in Category Acute 1 or Chronic 1	100 (110)	200 (220)
E2 – Hazardous to the Aquatic Environment in Category Chronic 2	200 (220)	500 (551)
Section ‘O’ – OTHER HAZARDS		
O1 – Substances or mixtures with a hazard statement EUH014	100 (110)	500 (551)
O2 – Substances and mixtures which in contact with water emit flammable gases, Category 1	100 (110)	500 (551)
O3 – Substances or mixtures with hazard statement EUH029	50 (55)	200 (220)

3. CHEMICALS STORED AT TYPICAL AP1000 PLANT

Chemicals are stored at the AP1000 plant on the turbine island and the nuclear island. The inventory and chemical content of each tank on the turbine island, nuclear island, and seawater cooling system are summarised in Tables 3-1, 3-2, and 3-3, respectively.

Table 3-1: Inventories on AP1000 Plant Turbine Island			
Tank	**Inventory**		**Chemical**
	m^3	**Gallons (US)**	
Turbine Island Chemical Feed System (CFS)			
MT01	3.0	800	Hydrazine or Carbohydrazide
MT02	3.0	800	pH control chemical – monoethanolamine (actual pH control additive used may differ)
MT03	3.0	800	Ammonium Hydroxide
MT04	3.0	800	Ammonium Hydroxide
MT05	0.9	240	Sodium Sulfite and Sodium Hydroxide
MT07	3.0	800	Polyphosphate
MT08	3.0	800	Ammonium Chloride
MT11	3.0	800	Ammonium hydroxide
Standby Diesel Fuel Oil System (DOS)			
MT01 A/B	454.2	120,000	No. 2 Diesel Fuel Oil
MT02 A/B	9.8	2,600	No. 2 Diesel Fuel Oil
MT03	2.5	650	No. 2 Diesel Fuel Oil
Fire Protection System (FPS)			
MT02	0.9	240	No. 2 Diesel Fuel Oil
Plant Gas System (PGS)			
Liquid	5.7	1,500	Nitrogen
Gas (3 bottles)	785.4	27,735 scf	Nitrogen
Liquid	5.7	1500	Hydrogen
Gas (1 bottle)	14.2	500 scf	Hydrogen
Liquid	2,967.6	104,800 scf	Carbon Dioxide
Central Chilled Water System (VWS)			
MT02/MT05	0.2	45	Sodium Molybdate
			Tolytriazole
MT02/MT05	0.2	45	Ethylene/Propylene Glycol
Zinc Addition Subsystem			
Zinc Addition	0.8	200	Zinc Acetate

Table 3-2: Inventories on AP1000 Plant Nuclear Island			
Tank	**Inventory**		**Chemicals**
	m^3	**Gallons (US)**	
Boric Acid Tank	302.8	80,000	Boric Acid
Hydrogen (liquid)	5.7	1,500	Hydrogen
Lithium^{7}Hydroxide	0.019	5	Lithium^{7}Hydroxide
Hydrazine	0.019	5	Hydrazine

Table 3-3: Chemical Inventory on Seawater Cooling System			
Tank	**Inventory**		**Chemicals**
	m^3	**Gallons (US)**	
Site-Specific	37.9	10,000	Polyacrylate or polyphosphate or orthopolyphosphate
Site-Specific	37.9	10,000	Sodium Hypochlorite
Site-Specific	37.9	10,000	Ammonium hydroxide

4. APPLICABILITY OF COMAH TO AP1000 PLANT DESIGN

The chemicals that are stored at the AP1000 plant fall under different categories according to COMAH regulations. The category for each substance, as well as the corresponding HSE risk phrases and COMAH regulation thresholds are summarized in Table 4-1. The risk phrase definitions are listed in Table 4-2.

The maximum predicted inventory of each tank of the standard AP1000 plant was listed in Tables 3-1, 3-2, and 3-3.

To calculate the maximum total inventory of each individual substance, it is assumed that each tank could potentially be 100% full of a single chemical.

The maximum total inventories on AP1000 plant can be compared against the COMAH specified thresholds of dangerous substances listed in Table 4.1 to identify those that would fall under COMAH regulations. This comparison is given in Table 4-3.

Table 4-1: AP1000 Plant Dangerous Substance Categories				
Chemical	**Dangerous Substance Category**	**Risk Phrases (Table 4-2)**	**COMAH Thresholds in tonnes (short tons)**	
			Lower-Tier	**Upper-Tier**
Turbine Island				
Ammonium hydroxide (30% w/v)	Dangerous for Environment, Corrosive, Toxic	R34 R36 R37 R38 R50	100 (110)	200 (220)
Carbon dioxide liquid	Non- flammable	N/A	-	-
Ethylene/Propylene Glycol	Extremely Flammable	R12 R67	10 (11)	50 (55)
Hydrazine (35% w/v)	Named Substance	R10 R23 R24 R25 R34 R43 R45 R50 R53	0.5 (0.6)	2 (2.2)
Hydrogen	Named Substance	R12	5 (6)	50 (55)
Nitrogen	Not Hazardous	N/A	-	-
No.2 Diesel fuel oil	Named Substance	R40	2500 (2,756)	25,000 (27,558)
Polyphosphate	Not Hazardous	N/A	-	-
Sodium Hydroxide	Corrosive	R35	-	-
Sodium Molybdate	Irritant	R36, R37, R38	-	-
Sodium Sulfite	Irritant	R31,R36,R38,	-	-
Tolytriazole (sodium) (15% w/v)	Harmful, Corrosive	R22 R34	-	-
Zinc Acetate	Harmful, Irritant	R22 R36	-	-
Nuclear Island				
Boric Acid (<4% w/v)	Toxic	R60 R61	50 (55)	200 (220)
Lithium^{7}Hydroxide	Harmful, Corrosive	R22 R35	-	-
Hydrazine (35% w/v)	Named Substance	R10 R23 R24 R25 R34 R43 R45 R50 R53	0.5 (0.6)	2 (2.2)

Table 4-1: AP1000 Plant Dangerous Substance Categories				
Chemical	**Dangerous Substance Category**	**Risk Phrases (Table 4-2)**	**COMAH Thresholds in tonnes (short tons)**	
			Lower-Tier	**Upper-Tier**
Hydrogen	Named Substance	R12	5 (6)	50 (55)
Seawater Cooling System				
Orthopolyphosphate	Not Hazardous	N/A	-	-
Polyacrylate	Not Hazardous	N/A	-	-
Polyphosphate	Not Hazardous	N/A	-	-
Sodium Hypochlorite (30% w/v)	Dangerous for Environment, Toxic, Corrosive	R31 R34 R50	100 (110)	200 (220)
Ammonium hydroxide (30% w/v)	Dangerous for Environment, Corrosive, Toxic	R34 R36 R37 R38 R50	100 (110)	200 (220)

Table 4-2: Risk Phrases

Risk Phrase	Definition		Risk Phrase	Definition
R1	Explosive when dry.		R21	Harmful in contact with skin.
R2	Risk of explosion by shock, friction, fire or other source of ignition.		R22	Harmful if swallowed.
R3	Extreme risk of explosion by shock, friction, fire or other sources of ignition.		R23	Toxic by inhalation.
R4	Forms very sensitive explosive metallic compounds.		R24	Toxic in contact with skin.
R5	Heating may cause an explosion.		R25	Toxic if swallowed.
R6	Explosive with or without contact with air.		R26	Very toxic by inhalation.
R7	May cause fire.		R27	Very toxic in contact with skin.
R8	Contact with combustible material may cause fire.		R28	Very toxic if swallowed.
R9	Explosive when mixed with combustible material.		R29	Contact with water liberates toxic gas.
R10	Flammable.		R30	Can become highly flammable in use.
R11	Highly flammable.		R31	Contact with acids liberates toxic gas.
R12	Extremely flammable.		R32	Contact with acid liberates very toxic gas.
R13	Extremely flammable liquefied gas.		R33	Danger of cumulative effects.
R14	Reacts violently with water.		R34	Causes burns.
R15	Contact with water liberates extremely flammable gases.		R35	Causes severe burns.
R16	Explosive when mixed with oxidizing substances.		R36	Irritating to eyes.
R17	Spontaneously flammable in air.		R37	Irritating to respiratory system.
R18	In use, may form inflammable/explosive vapour-air mixture.		R38	Irritating to skin.

Table 4-2: Risk Phrases

Risk Phrase	Definition		Risk Phrase	Definition
R19	May form explosive peroxides.		R39	Danger of very serious irreversible effects.
R20	Harmful by inhalation.		R40	Limited evidence of a carcinogenic effect.
R41	Risk of serious damage to the eyes.		R55	Toxic to fauna.
R42	May cause sensitization by inhalation.		R56	Toxic to soil organisms.
R43	May cause sensitization by skin contact.		R57	Toxic to bees.
R44	Risk of explosion if heated under confinement.		R58	May cause long-term adverse effects in the environment.
R45	May cause cancer.		R59	Dangerous to the ozone layer.
R46	May cause heritable genetic damage.		R60	May impair fertility.
R47	May cause birth defects.		R61	May cause harm to the unborn child.
R48	Danger of serious damage to health by prolonged exposure.		R62	Risk of impaired fertility.
R49	May cause cancer by inhalation.		R63	Possible risk of harm to the unborn child.
R50	Very toxic to aquatic organisms.		R64	May cause harm to breastfed babies.
R51	Toxic to aquatic organisms.		R65	Harmful: may cause lung damage if swallowed.
R52	Harmful to aquatic organisms.		R66	Repeated exposure may cause skin dryness or cracking.
R53	May cause long-term adverse effects in the aquatic environment.		R67	Vapours may cause drowsiness and dizziness.
R54	Toxic to flora.		R68	Possible risk of irreversible effects.

Table 4-3: Comparison of AP1000 Plant Design with COMAH Regulations

Chemical	Max Conc *(% w/v)*	Total Inventory m^3 (ft^3)	Density kg/m^3 (lb/ft^3) *(Note 1)*	Total Inventory *tonnes (short tons)*	COMAH Thresholds *tonnes (short tons)*		COMAH Applies? (Y/N)
					Lower-Tier	Upper-Tier	
Ammonium hydroxide	30%	14.1 (498)	900 (56.2)	12.7 (14)	100 (110)	200 (220)	No
Carbon dioxide liquid	100%	2967.6 (104,800)	762 (48)	2261.3 (2493)	-	-	No
Ethylene/ Propylene Glycol	100%	0.2 (7)	1,113 (69)	0.2 (0.22)	10 (11)	50 (55)	No
Hydrazine	35%	3.05 (108)	1,011 (63.1)	3.1 (3.4)	0.5 (0.6)	2 (2.2)	**Yes**
Hydrogen	100%	19.9 (703)	70 (4)	1.4 (1.5)	5 (6)	50 (55)	No
Nitrogen	100%	791.1 (27,937)	808 (50)	639.2 (705)	-	-	No
No. 2 Diesel fuel oil	100%	467.4 (16,506)	880 (55)	411.3 (453)	2,500 (2756)	25,000 (27,558)	No
Orthopoly phosphate	100%	37.9 (1,338)	1,350 (84)	51.2 (56)	-	-	No
Polyacrylate	100%	37.9 (1,338)	1,310 (82)	49.6 (55)	-	-	No
Polyphosphate	100%	37.9 (1,338)	1,250 (78)	47.4 (52)	-	-	No
Sodium Hydroxide	50%	0.9 (32)	1,515 (94.6)	1.4 (1.50)	-	-	No
Sodium Hypochlorite	30%	37.9 (1,338)	1,210 (75.5)	45.9 (50.6)	100 (110)	200 (220)	No
Sodium Molybdate	100%	0.2 (7)	3,780 (236)	0.8 (0.88)	-	-	No
Sodium Sulfite	30%	0.9 (32)	1,150 (71.8)	1.04 (1.15)	-	-	No
Tolytriazole (sodium)	15%	0.2 (7)	1,200 (74.9)	0.24 (0.26)	-	-	No
Zinc Acetate	100%	0.8 (28)	7140 (446)	5.4 (6)	-	-	No

Table 4-3: Comparison of AP1000 Plant Design with COMAH Regulations

Chemical	Max Conc *(% w/v)*	Total Inventory *m^3 (ft^3)*	Density *kg/m^3 (lb/ft^3) (Note 1)*	Total Inventory *tonnes (short tons)*	COMAH Thresholds *tonnes (short tons)*		COMAH Applies? (Y/N)
					Lower-Tier	Upper-Tier	
Boric Acid	4%	302.8 (10,693)	1,000 (62.4)	302.8 (333.8)	-	-	No
Lithium[7] Hydroxide	100%	-	-	0.005 (0.006)	-	-	No
Hydrazine	100%	-	-	0.1 (0.11)	0.5 (0.6)	2 (2.2)	No
Hydrogen (liquid)	100%	5.7 (201)	70 (4)	0.4 (0.44)	5 (6)	50 (55)	No

Notes:

1. Some of the chemicals are solutions (not 100% weight). Therefore, the densities for the following have been estimated as follows using supplier material safety data sheets for the solutions. This provides a reasonable estimate of the density of the solution.

5. SUMMARY AND CONCLUSIONS

Based on the current specification, the AP1000 plant site will be an upper tier COMAH site because of the proposed hydrazine inventory.

The hydrazine tank(s) potentially contains 3.1 tonnes (3.4 tons) of hydrazine, which is above the upper tier COMAH threshold of 2 tonnes (2.2 tons).

6. REFERENCES

1. Statutory Instrument 2015 No. 483, "The Control of Major Accident Hazards Regulations 2015," Health and Safety Executive.

2. Council Regulation (EC) No 440-2008 of 30 May 2008 (refer to Official Journal of the European Union, 31.5.2008, L142).