**Variable Definition and Formulation**

1, if the Warehouse in location *i* is open

0, otherwise. *i* {A, F, M, R, S}

Wi =

1, if the Distribution Center in location *j* is open

0, otherwise. *j* { B, F, M, A, V, R, H }

Dj  =

Variables Definition

Xij Number of vials transported from Warehouse *i* to Distribution Center *j*

*i* ϵ {A, F, M, R, S} and *j* ϵ {B, F, M, A, V, R, H}

Yja  Number of vials transported from Distribution Center *j* to Administration Location *a*

*j* ϵ {B, F, M, A, V, R, H} and *a* ϵ {L, N, C, MD, M, H, O, S, D, J}

Cij Cost of shipping from Warehouse *i* to Distribution Center *j*

*i* ϵ {A, F, M, R, S} and *j* ϵ {B, F, M, A, V, R, H}

Cja Cost of shipping from Distribution Center *j* to Administration Location *a*

*j* ϵ {B, F, M, A, V, R, H} and *a* ϵ {L, N, C, MD, M, H, O, S, D, J}

Fi Fixed Cost of opening a Warehouse in location *i, i* ϵ {A, F, M, R, S}

Fj Fixed Cost of opening a Distribution Center in location *j, j* ϵ {B, F, M, A, V, R, H}

Fv Fixed Cost of disposing of unused vials

Dv Demand for vials

Vi Variable Cost of Warehouse production

Objective Function

Obj: **Min:** Wi Fi + ΣCij + ΣXij Vi + Dj Fj + ΣCja + Fv Yja - Dv

Constraints

XAB **+** XAF + XAM + XAA + XAV + XAR + XAH <= 250,000Wa

XFB **+** XFB + XFA + XFA + XFV + XFR + XFH <= 250,000Wf

XMB **+** XMF + XMM + XMA + XMV + XMR + XMH <= 250,000Wm

XRB **+** XRF + XRM + XRA + XRV + XRR + XRH <= 250,000Wr

XSB **+** XSF + XSM + XSA + XSV + XSR + XSH <= 250,000Ws

XBL **+** XBN + XBC + XBMD + XBM + XBH + XBO + XBS + XBD + XBJ <= 4,800,000Db

XFL **+** XFN + XFC + XFMD + XFM + XFH + XFO + XFS + XFD + XFJ <= 4,800,000DF

XML **+** XMN + XMC + XMMD + XMM + XMH + XMO + XMS + XMD + XMJ <= 4,800,000Dm

XAL **+** XAN + XAC + XAMD + XAM + XAH + XAO + XAS + XAD + XAJ <= 4,800,000Da

XVL **+** XVN + XVC + XVMD + XVM + XVH + XVO + XVS + XVD + XVJ <= 4,800,000Dv

XRL **+** XRN + XRC + XRMD + XRM + XRH + XRO + XRS + XRD + XRJ <= 4,800,000DR

XHL **+** XHN + XHC + XHMD + XHM + XHH + XHO + XHS + XHD + XHJ <= 4,800,000DH

XBL **+** XFL + XML + XAL + XVL + XRL + XHL >= 361,796

XBN **+** XFN + XMN + XAN + XVN + XRN + XHN >= 315,967

XBC **+** XFC + XMC + XAC + XVC + XRC + XHC >= 218,106

XBMD **+** XFMD + XMMD + XAMD + XVMD + XRMD + XHMD >= 245,066

XBM **+** XFM + XMM + XAM + XVM + XRM + XHM >= 200,343

XBH **+** XFH + XMH+ XAH + XVH + XRH + XHH >= 197,602

XBO **+** XFO + XMO+ XAO + XVO + XRO + XHO >= 74,570

XBS **+** XFS + XMS+ XAS + XVS + XRS + XHS >= 35,611

XBD **+** XFD + XMD+ XAD + XVD + XRD + XHD >= 128,869

XBJ **+** XFJ + XMJ+ XAJ + XVJ + XRJ + XHJ >= 30,111

Wia +Wif + Wim + Wir + Wis >= 1

Djb +Djf + Djm + Dja + Djv +Djr + Djh >= 1